College

A MANUAL OF THE MOSSES OF WESTERN PENNSYLVANIA

BY

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WITH FIFTY-FOUR FULL-PAGE PLATES FROM DRAWINGS BY THE AUTHOR.

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PREFACE*

The aim in the preparation of this Manual has been to make it a practical handbook applying particularly to the region of Western Pennsylvania and embodying all that is at present known regarding the occurrence and distribution of mosses within that area. As a matter of fact, the Manual will be found to apply also to the adjacent regions of central Pennsylvania, extreme southwestern New York, eastern Ohio, and northern West Virginia.

When the present writer took charge of the botanical collections in the Carnegie Museum in 1904 he found that the Herbarium, aside from certain specimens collected by Mr. D. A. Burnett in McKean County, a few years previously, contained but little to represent the rich flora of mosses and liverworts to be expected in the western end of Pennsylvania. One of the aims at the Herbarium of the Carnegie Museum has been to assemble a very complete and comprehensive collection of all the plants to be found in the general region in which Pittsburgh is situated, and, in the prosecution of this work, the writer has been enabled to visit all of the counties in the western half of Pennsylvania and also adjacent portions of Ohio and West Virginia. Certain localities in this general region have been made the subject of detailed ecologic and systematic study and collection—particularly the peninsula of Presque Isle, near Erie, Pennsylvania; the extensive Pymatuning Swamp in Crawford County, Pennsylvania; the mountainous region in the vicinity of Ohio Pyle, Fayette County; and the larger portion of Allegheny County, especially in the vicinity of Pittsburgh. From these and other localities visited extensive collections of mosses have been made and the amount and representative nature of the herbarium material thus available for study have become such that it has been deemed advisable to prepare a treatise embodying the results of the work accomplished, thus placing within the reach of other students of the mosses within the region a convenient means of identifying and checking up their own collections. It is hoped that with all its faults this Manual may be to some extent the means of stimulating bryological study in a region of whose mosses there is yet much to be learned.

In the preparation of this Manual the author has taken as the taxonomic standard the monumental work of Warnstorf, Ruhland, and Brotherus, brought to completion in 1909, in Engler & Prantl's "Die Natuerliche Pflanzenfamilien," Teil I, Abteilung III. In the characterization of the various orders,

* This work in a more condensed form was submitted as a major thesis in candidacy for the degree of Doctor of Philosophy in the University of Pittsburgh, June, 1911.

families, and genera, these authors have been followed closely, and, while there is much to be said against their arrangement of families in certain cases, it is nevertheless very probable that their work will remain for a long time the standard and that, from the standpoint of convenience at least, a similar sequence of families in this Manual is justified. In the determination of the various species the author has, naturally, had recourse to the various works of Sullivant, Lesquereux & James, Barnes & Heald, Grout, and others among the American bryologists, and, among the European bryologists, particularly Dixon and Jameson. In the determination of the Sphagnums the works of Warnstorf, Roth, and Braithwaite were found particularly useful, while in the treatment of synonymy the main reliance has been placed on the *Index Bryologicus* of E. G. Paris.

In nomenclature the rulings of the International Botanical Congress, held in Brussels in 1910, have been followed, taking as the starting point the *Species Muscorum* of Hedwig (1801) and the three subsequent "Supplements" by Schwaegrichen, Hedwig's having been the first comprehensive work to deal with the mosses in a modern way. In the present Manual the principle of priority has been followed without exception, dating from Hedwig, and a few new combinations have been found necessary. Plant names which have been adopted from pre-Hedwigian sources without important changes in nature or in status are indicated by a double citation of authors, the pre-Hedwigian author being cited first, followed by a comma, and then the name of Hedwig or Schwaegrichen or of the post-Hedwigian author, as the case may be. In case the name of the plant has been derived from pre-Hedwigian sources, but has been used in a different rank or, in the case of species, has been transferred from one genus to another, the name of the pre-Hedwigian author has been enclosed in square brackets.

So far as it has been possible to do so the descriptions of the various species have been drawn up from specimens collected in the region covered by the Manual. Where specimens of species reported as occurring in the region or thought likely to be eventually discovered in the region have not been available for description, the description has been in part compiled and in part drawn up from specimens from other regions. It has been the aim to represent by original drawings, completely and in considerable detail every species of which specimens collected in the region of the Manual have been available. In the list of specimens, which, in the Manual, follows the description of each species, the particular specimen figured has been so indicated and the fact that the specimen has been thus figured has been recorded on the pocket containing the specimen in the Herbarium of the Carnegie Museum. All drawings

are the work of the author alone, and, with the exception of a few of the larger habit sketches, all drawings have been first traced by means of the camera lucida, thus insuring a reasonable degree of accuracy in the relative position, shape, and size of the various structures figured. The drawings of most of the dissections have been made from permanent glycerine-jelly mica-covered slides which are to be found in the Herbarium in the proper pocket with the specimen.

Special acknowledgement should be here made to Dr. W. J. Holland, Director of the Carnegie Museum, without whose generous and kindly support the collections could not have been made and properly studied nor the Manual prepared. To Professor J. C. Fettermann, of the University of Pittsburgh, is due many thanks for suggestions and criticism, and to Mrs. O. E. Jennings is due much credit for assistance in the collection of specimens, in the preparation of the manuscript, and in the arrangement of the figures on the plates.

Otto E. Jennings,

Carnegie Museum, September, 1912.

INTRODUCTION

In a work containing keys and descriptions, so arranged as to make easier the identification of the mosses of any region, it is desirable that a brief sketch of the general life history of the mosses be included. In such a sketch it is not necessary to enter upon a discussion of the many details of minute structure and behavior which, although interesting and important in themselves and also for the light thus thrown upon genetic relationships, are yet of but little practical value in a systematic manual where an easy and quick determination of the identity of the plant is the primary aim.

Speaking broadly, the life history of a moss may be said to begin with a minute single-celled *spore,* usually spherical in shape, which, under suitable conditions, germinates and grows out as a slender thread or *filament,* which upon further growth may form a matted felt-like layer, or may flatten out into a more or less lobed body spoken of as a *thallus,* or may simply form a solid cell mass, sometimes consisting of but a few cells. In either case the structure resulting from the growth of the germinated spore is termed the *protonema.* The protonema usually gives rise to buds, which in most mosses grow to be the green leafy shoots which are ordinarily known as moss plants, after which the protonema usually disappears. In a few of the mosses the protonema persists indefinitely as a green felt-like layer on the soil or other substratum. The stems of the green shoots resulting from the growth of protonemal buds usually send out hair-like *rhizoids* which function as roots in holding the plants in place and sometimes act as absorbing organs. The leaves on these green shoots are sessile and with the exception of the midribs (*costae*) are almost uniformly of but one cell in thickness.

This whole phase in the life-history of a moss, beginning with the spore and including the protonema and the leafy shoot, is spoken of as the *gametophyte* or sexual generation. The gametophyte is a sexual plant in that it bears, in definite clusters surrounded by modified leaves called *perichaetial leaves,* the reproductive male and female organs which give rise respectively to the *sperm* and *egg.* These clusters of reproductive organs surroundd by more or less modified perichætial leaves are known as *perichaetia.* When the sperms and eggs are borne either in the same perichætium or in different perichætia on the same plant the plant is spoken of as *monoicous,* but when they are produced upon different plants, *dioicous.*

The sperms are borne in a globose or more or less club-shaped sac, usually mounted upon a stalk, and this sac is termed the *antheridium.* When ripe the antheridia absorb water and

the thin wall, consisting of but a single layer of sterile cells, is ruptured, thus liberating the mass of fertile cells, each of which immediately develops into a sperm. Each sperm consists of a more or less oval or club-shaped and curved body, always free-swimming by means of two long slender *cilia* attached at one end of the body.

The egg is borne in a special organ termed the *archegonium.* The archegonium is usually more or less stalked and is differentiated into a swollen basal portion termed the *venter,* which contains the one fertile egg cell, and the more slender tapering *neck* terminating the archegonium above and containing an axial row of sterile cells termed the *canal cells,* the basal one of which rests directly upon the egg cell. When the archegonium becomes ripe the canal cells break down into a slimy mass of protoplasm, some of which may escape at the tip of the neck. Sperms are attracted in some manner by the slimy protoplasm thus escaping if there is a sufficient film of moisture present so that they may swim about in the perichætium or on the surface of the plant. Having reached the apex of the archegonium the sperms may enter the canal left open by the disintegration of the canal cells and eventually one of the sperms will reach the egg and, uniting with it, bring about fertilization.

After fertilization the egg immediately begins development as the *sporophyte* but remains enclosed in the venter of the archegonium, which to a considerable extent expands with the development of the young sporophyte but is finally ruptured and usually carried upward on the tip of the sporophyte, where it is then known as the *calyptra* or hood. The ultimate end of the sporophyte is the production of spores which arise entirely by division of cells and are thus known as *asexual* cells. The sporophyte is usually almost devoid of chlorophyll and it develops at its base an absorbing organ termed the *foot* through which its food is obtained from the gametophyte. The sporophyte usually develops more or less of a stalk which is termed the *seta* and which bears at the apex a globose to more or less elongated *capsule* in which the asexual spores form. The method of opening (*dehiscence*) of the capsule and the structures often associated with the dispersal of the spores are varied and are so characteristic for the various systematic groups and species that the capsule becomes highly important for the correct systematic placing of the plants.

Of the mosses there are to be distinguished three well-marked Orders known as the *Sphagnales,* the *Andreaeales,* and the *Bryales.* The order *Sphagnales* comprises the one genus *Sphagnum.* These mosses are known as Peat Mosses or Bog Mosses, their characteristic habitat being bogs and the mar-

gins of ponds and small lakes. The general color is grayish green, the stems are usually erect in dense tufts or mats and bear at intervals fascicles of short and slender branchlets. The capsules are usually more or less chestnut colored and globose, while the leaves possess a peculiar and characteristic structure consisting of a meshwork of slender green cells enclosing inflated hyaline cells whose walls are more or less porose.

The *Andreaeales* contain the one genus *Andreaea,* all being small tufted mosses growing on siliceous rocks in mountainous regions. The capsule splits open by four vertical slits which, however, do not reach the apex.

The *Bryales* comprise by far the greatest number of the mosses. The capsule in the *Bryales* varies from globose to ovate or pyriform or elongated cylindric. The cells which give rise to the spores are known collectively as *sporogenous tissue* and this tissue occupies but a small portion of the volume of the capsule, being arranged in the form of a hollow tube or cylinder vertically placed and open at both ends. The sterile tissues occupying the hollow part of this tube constitute the *columella.* The outer wall of the capsule usually contains more or less green chlorophyll and the middle portion of this wall is more or less loosely arranged and contains hollow spaces. The capsule is covered by an *epidermis,* perforated by *stomata* in most mosses. The stomata are usually most highly developed on the rounded or tapering base of the capsule which is often more or less distinct and is known as the *collum* or *neck.* In the ripening of the capsule the sterile tissues of the wall and of the columella largely disappear, leaving the capsule filled with a mass of spores. In some species the thin wall of the capsule bursts irregularly, this type of dehiscence being known as *cleistocarpous.* In other species the top of the capsule separates as a *lid* or *operculum.* The separation of the lid is often facilitated by the modification of a series of epidermal calls termed the *annulus,* which usually becomes highly hygroscopic and is often deciduous. The sterile tissues immediately beneath the lid are usually more or less highly modified to form a single or double series of pointed structures known collectively as the *peristome.* The pointed structures constituting the outer series in the double peristome or the single series in a simple peristome are known as *teeth,* while the inner and more delicate series of the double peristome are known as *segments.* Between the individual segments are in many species of mosses very delicate hair-like structures known as *cilia.* Somtimes the cilia are in groups of two or more alternating with the segments. The peristome is usually very hygroscopic, curling inward and closing the mouth of the capsule in damp air and opening outward and allowing the free dispersal

of the spores in dry air. Species whose capsules stand vertically are not so likely to have well-developed peristomes as are species whose capsules are inclined or vertical, this variation corresponding to the need for the regulation of spore dispersal.

The *Sphagnales* are most abundant in the cooler parts of the North Temperate zone, often constituting there large tracts of vegetation. By their aquatic or semi-aquatic manner of life and their apical method of growth, dying away below as they grow upward, they tend to form great tufts or mats, often completely filling depressions and bogs and by the accumulation of the encircling mats around ponds and small lakes tending to fill them also. The mats hold water like a sponge and, being somewhat intiseptic, the dead portions below the mat do not decay but become converted into peat, which, especially in certain parts of Europe, has served a very important purpose as fuel. Although a few *Sphagnum* bogs of limited area occur in the mountains of central Pennsylvania the only bogs of any considerable extent in our region are those in the northwestern part of Pennsylvania, particularly in the Pymatuning Swamp, between Linesville and Hartstown, in Crawford County. Here, in places, the *Sphagnum* and Tamarack practically reign supreme for acres in extent and the peat deposits are apparently quite deep. As may be seen in the treatment of *Sphagnum* in this Manual, the Pymatuning Swamp has yielded a goodly share of the species reported for our region.

No *Andreaeales* have as yet been reported in our region, although they occur in the mountains both to the south and to the northeast. It is not unlikely that *Andreaea* will yet be found to occur in the mountains of central Pennsylvania upon some of the sandstone ridges.

The *Bryales* constitute by far the greater number of moss species found in Pennsylvania. Western Pennsylvania as a whole offers quite a variety of habitats and its moss flora is fairly large, although, considering the area covered, there is a noticeable lack of certain species more or less peculiar to high elevations, to outcrops of limestone, and to low-lying marshes and river swamps.

The northwestern part of Pennsylvania, in a triangular area extending as far south as Beaver County and as far east as Warren County, was worked over by the ice in the Glacial Period and is still in a rather youthful stage of erosion, with a number of small lakes and ponds and considerable areas of poorly drained lands. Occasional *Sphagnum* bogs occur here as well as swamps along the flood-plains of some of the streams. Such conditions offer suitable habitats for a number of aquatic and swamp-inhabiting species of the *Bryales* which are not to be found at all or are quite rare in the rest of

Western Pennsylvania. Presque Isle, near Erie, is a sandspit of about six miles in length and over a mile in width at its outer extremity and, containing as it does a variety of ponds, lagoons, woodland swamps, marshes, and dry woods, it affords certain habitats which are not duplicated anywhere else in our region.

The remainder of the region covered by this Manual is the rather characteristic hilly country of the Allegheny Plateau, ranging in altitude from about 700 feet above the sea, along the flood-plain of the Ohio River, to about 2,800 feet above the sea in the mountains of central Pennsylvania. In the western, southwestern and northeastern parts of our region the general topography is that of an elevated tableland in an active state of erosion, the rocks being largely sandstones and shales, and mainly non-calcareous. There are many steep valleys and precipitous rock exposures with a minimum of swampy areas or ponds. The flood-plains which have developed along the Ohio River, the Monongahela River, the lower Allegheny River, and the larger tributaries of these streams have been so largely disturbed by the activities of man that they now offer but few opportunities for collection in what must have once been habitats rich in *Bryales*.

As the smaller streams in Western Pennsylvania are ascended, however, the valleys often rapidly narrow to a more or less steep rock-walled canon where erosion is highly active. In the narrow valleys the forest covering has not been very largely disturbed by man and the damp, cool, shaded habitat with varying substrata of decaying wood, rich loam, shaly soil, bare rock, or living bark, conduces to a rich and varied flora of the *Bryales*. Above this area of active erosion there will usually be found, in the headwaters of the streams, a region which has remained largely unaltered from a former advanced stage of physiographic development and which is characterized by wide valleys with gently sloping soil-covered sides rising to broadly rounded and soil-covered hills. These rounded hills, whose height above the bottoms of the adjacent rounded valleys is rarely more than 300 to 350 feet, are in many places still covered with the native forest consisting mostly of the White Oak, but the moss flora of these forests is poor.

Good collecting ground for the *Bryales* is also to be found in the mountains of the eastern and southeastern parts of the region covered by this Manual, particularly in the steep and rocky gorges which have been cut through the sandstone ridges by the larger streams. Perhaps the best collecting ground for the *Bryales* in our whole region is to be found in the vicinity of Ohio Pyle, in Fayette County, where the Youghiogheny River and its larger tributaries have cut out

wild and rocky gorges sometimes a thousand feet or more in depth. Somewhat similar and perhaps but little inferior to the Ohio Pyle region are localities along the gaps cut through the ridges by the Conemaugh and Loyalhanna Rivers and the eastward-flowing Juniata and West Branch of the Susquehanna River.

The northeastern part of our region is an elevated tableland which is so dissected as to be rather hilly in some districts but the flora is quite northern in its character. The forests were largely composed of Hemlocks, White Pines, Birches, Beeches, and Maples and the moss flora is found to contain a rich development of *Bryales*, of which not a few are absent or rare in the Oak and Chestnut forests to the south and southwest.

The total number of genera, species, and varieties recognized in this Manual as having been collected or authoritatively reported in the confines of western Pennsylvania are as follows, twenty-nine families being represented:

	Genera	Species	Varieties
Sphagnales	1	14	10
Bryales	102	234	20
Total	103	248	30

Directions for Collecting, Preparing, and Preserving Specimens of Mosses

For the benefit of those who may not be familiar with the usual methods of collection and preservation of bryological specimens the following notes may be of use:

Specimens of *Bryales* should be collected in fruit (ripe sporophytes) as far as possible. Specimens of *Sphagnum* are desirable in fruit, but determination is best made in this group from the vegetative characters. Specimens of mosses when collected should be placed at once in envelopes or other suitable paper pockets and the data of collection, especially habitat, should be written upon the envelope. Many collectors would prefer to number the envelope and under the corresponding number make note of the data in a note-book. Collections may be carried home in a basket or regular tin collecting case and, if carefully placed in the envelopes in the first place, the specimens need not be taken out of the envelopes but the envelopes should be placed between blotting papers or newspapers and subjected to a slight weight and so placed that they will soon dry. A few books or two or three bricks are usually sufficient weight for drying a package of mosses. Too much weight should be guarded against, as the habit of the plant, i. e., the position assumed by leaves, branches, etc., is often a great help in determining the species, and, if too much weight is used in drying, the specimens will be so flattened as to destroy these characters.

When dry the specimens may be placed in paper pockets made from a rectangular piece of paper by folding up the lower part of the rectangle to within about one half-inch of the upper edge and then folding down this half-inch flap over the first flap. The two ends should now be folded backward for about one half-inch each and the pocket is then complete and ready for the reception of the moss. The regulation method in most larger herbaria is to glue this pocket in the middle of the back, midway between the two folded ends, to a so-called "herbarium sheet" which is uniformly of white stiff paper measuring 11½ by 16½ inches. For small private collections smaller sizes are sometimes used. On the lower right-hand corner of this sheet is written the name of the species, and the number of specimens which such a sheet will accommodate is, of course, restricted only by the space occupied by the pockets. The label for each specimen should be fastened to the narrow (half-inch) flap at the upper edge of the pocket and should always contain the name of the species, the exact locality and habitat of the specimen, the name of the

collector, and the date of the collection. If material has been collected in sets for distribution the label should so state and a number should be assigned to the various species so that duplicate specimens reaching different botanists may be definitely correlated. It is often advisable to add to the label also the name of the botanist who identified the specimen, especially if he be a specialist.

For any extended study of the mosses, either *Sphagnales* or *Bryales,* it is practically necessary to have at hand besides a pocket lens of some sort, a dissecting lens and a compound microscope. A dissecting lens may be rigged up by providing some sort of a frame for holding the ordinary pocket lens at the right distance above the table. This can be done by some such simple contrivance as knitting needles and corks, in the absence of anything better. The writer has found very satisfactory the ordinary dissecting stand, which may be obtained from any dealer in scientific apparatus, the stand preferably fitted with a rack-and-pinion adjustment for focussing the lens. The writer has used with good results a doublet lens (three-quarter inch) magnifying about four diameters and a one-fourth inch aplanat lens magnifying about seven diameters. The compound microscope should be fitted with a one-inch and also preferably a two-inch eye-piece and the customary two-thirds and one-sixth objectives. A sub-stage condenser is a great convenience and should be provided with diaphragms both above and below.

In preparing a moss for microscopic study the writer proceeds as follows: A portion of the specimen, usually consisting of a whole plant, is selected and is soaked in water until it is soft and relaxed. A thin square of mica an inch or more in width is prepared and placed on an ordinary glass microscope slide, and upon it is placed a drop of a ten per cent. solution of glycerine in water which is kept already prepared in a small bottle with a medicine dropper fastened into the stopper. The glass slide with the mica square and solution in position are placed on the stand of the dissecting microscope. With small forceps and with the aid of needles mounted in wooden handles the moss is now carefully dissected and the parts suitably disposed on the mica square in the film of ten per cent. glycerine. It is usually best to place on the mica square some thin cross-sections of the stem of the moss, cut with a scalpel or knife or fine scissors, some stem-leaves, some branch-leaves, some perichætial leaves or, better, the whole perichaetium dissected apart but not widely scattered, and then the capsule so dissected as to show a patch of the epidermis from the base of the capsule, the annulus, the peristome, both outer and inner if they are present, and the spores.

Another thin mica square is now selected a little smaller than the first one used and upon it is placed a small chunk of glycerine-jelly, which is melted by holding the square in the forceps over a suitable source of heat—the writer holds the square over the electric bulb of his desk light. The glycerine when melted is smeared over the surface of the mica, which is then inverted and quickly but carefully placed on the square on which the dissections are disposed. To prevent the dissected objects from changing their position too much, and to obviate the inclusion of air-bubbles, it is best to lay the square which is to serve as cover so that one edge only comes into contact with the other square and then let the cover settle down gradually, thus driving the air out in front of the gradually advancing line of contact of the mica and mounting medium. The slide is now ready for study under the compound microscope and after this it may be placed in the paper pocket along with the specimens from one of which the dissections were made. In order to insure greater permanency of the slide, as thus made, some workers advocate sealing the slide by running a little ring of Canada balsam around the edge of the smaller mica square, thus keeping the air away from the glycerine jelly and preventing any further drying out. The object of placing the dissections in the ten per cent. solution of glycerine is to gradually allow the dissections to accommodate themselves to increasing density of solutions; if the dissections were transferred immediately from pure water to the melted glycerine jelly there would in most cases be much shrinkage and curling, thus spoiling the slide for purposes of study. In a few cases even the transferrance from water to ten per cent. solution and thence to the jelly is too great a change and in such cases it is necessary to pass the dissections through a series of solutions of increasing glycerine per cent., up to a strong solution, before using the glycerine-jelly. Another way is to place the dissections in weak glycerine solution and keep adding more solution as the water evaporates from the first, thus gradaully increasing the density.

ABBREVIATIONS AND SIGNS USED IN THE MANUAL

cm., Centimeter, equals the one-hundredth part of a meter, or about two-fifths of an inch.

mm., Millimeter, equals one-tenth of a centimeter.

D.A.B., D. A. Burnett.

G.K.J., Grace K. Jennings (Mrs. O. E. Jennings).

J.A.S., Dr. John A. Shafer.

mm., Millimeter, equals about one twenty-fifth of an inch.

O.E.J., O. E. Jennings.

- The short dash used between figures or between words denotes either an intermediate state or a variation from one to the other extreme.

ANALYTICAL KEY TO THE GENERA OF MOSSES OF WESTERN PENNSYLVANIA

Order I.—*SPHAGNALES*

Whitish mosses with fasciculate branches, mostly bog plants; leaf-cells of two kinds,—large hyaline ones separated by narrow chlorophyllose ones; ecostate; operculate but with no peristome. *Sphagnum, p. 23*

Order II.—*ANDREAEALES*

Dark colored or blackish alpine or subalpine plants growing in cushions on granitic or slaty rocks; either costate or ecostate; leaf-cells small and quite opaque; capsule dehiscing by four longitudinal slits, the valves remaining united at the apex. *Andreaea, p. 46*

Order III.—*BRYALES*

Leaves various but not sphagnoid, costate or ecostate; capsule dehiscing irregularly or, more often, by a deciduous operculum, often furnished with a peristome, never four-valved as in *Andreaea*, plants largely green.....I.

I. Sporophyte borne at the apex of the main stem, sometimes appearing lateral by the growth of a branch..... *A. Acrocarpi, p. 48*

I. Sporophyte borne at the apex of a short lateral branch..... *B. Pleurocarpi, see p. 16*

A. ACROCARPI

1. Capsule non-operculate..... 2.
1. Capsule operculate.....10.
   2. Green protonema persistent; plants fruiting in autumn..... *Ephemerum, p. 127*
   2. Green protonema not persistent, plants fruiting mainly in spring. 3.
3. Spores few, about 16 to 20, smooth, about 0.2 mm. in diameter..... *Archidium, p. 48*
3. Spores numerous, rarely exceeding 0.05 mm. in diameter..... 4.
   4. Leaf-margins plane or involute. 5.
   4. Leaf-margins more or less revolute ..... 9.
5. Capsules pyriform, with a distinct neck 6.
5. Capsules globose to ovoid..... 7.
   6. Green protonema occasionally abundant; neck none; capsule acute.... *Sporledera, p. 49*
   6. Green protonema sparse; usually none; neck more or less well developed; capsule rostrate..... *Bruchia, p. 50*
7. Leaves crisped when dry, strongly papillose on both sides; operculum rudimentary but persistent..... *Astomum, p. 89*
7. Leaves not crisped when dry, smooth. 8.
   8. Calyptra cucullate; leaves linear-lanceolate to lanceolate-subulate... *Pleuridium, p. 52*
   8. Calyptra campanulate; leaves lanceolate-ovate to lanceolate-obovate, dentate or serrate..... *Physcomitrella, p. 130*

9. Capsule apiculate; leaves entire, papillose ..... *Phascum, p. 100*
9. Capsule not at all or very slightly apiculate; leaves erose-denticulate at the apex, smooth ..... *Acaulon, p.129*
10. Protonema persistent; plants practically stemless; leaves ecostate; calyptra splitting down one side and usually remaining attached to the seta ..... *Discelium, p. 126*
10. Protonema not persistent; calyptra not as above. (With a large inflated hypophysis. *Splachnum, p. 125*) 11
11. Peristome teeth none, or if present articulate 12
11. Peristome teeth not distinctly articulate 60
12. Peristome present, sometimes imperfect 13
12. Peristome none 52
13. Leaves distichous, dorsally winged and clasping at the base 127
13. Leaves not distichously clasping and dorsally winged 14
14. Leaves consisting of costa only, outer cells large and empty, inner small and chlorophyllose ..... *Leucobryum, p. 75*
14. Leaves with a lamina consisting mainly of one layer of more or less uniform cells 15
15. Peristome single, 16 or 32 toothed; teeth without a median longitudinal line on the exterior face 16
15. Peristome double, with 16 outer teeth and an inner variously segmented or almost lacking membrane; teeth with a median longitudinal line on the exterior face. 37
16. Capsule more or less octagonal, the angles with differentiated cells, when dry 8-striate and furrowed... *Rhabdoweisia, p. 64*
16. Capsule not octagonal, or, if plicate, the cells uniform 17
17. Exterior face of teeth longitudinally striate 18
17. Exterior face of teeth smooth or papillose, not longitudinally striate 24
18. Leaves with large hyaline or brownish alar cells 22
18. Leaves without differentiated alar cells 19
19. Leaf-cells strongly and coarsely papillose ..... *Oreoweisia, p. 50*
19. Leaf-cells smooth 20
20. Peristome of 16 broad solid teeth, sometimes somewhat bifid at the apex, smooth and strongly hygroscopic ..... *Seligeria, p. 58*
20. Peristome of 16 narrow, prolonged, more or less two-parted, minutely striate or papillose teeth 21

21. Capsule cernuus, with a long and inflated neck; teeth cleft or perforate..... *Trematodon, p. 51*
21. Capsule erect or inclined; neck short or none; teeth cleft to the middle into two filiform divisions ..... *Dicranella, p. 60*
22. Monoicous; leaves tufted; capsules strumose, costa with distinctly heterogeneous tissues ..... *Oncophorus, p. 65*
22. Dioicous; leaves flexuose-spreading or secund; capsule more or less distinctly strumose 23
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80. Primary stems bearing the sporophytes and not stoloniform; branch and stem leaves not markedly dissimilar; paraphyllia often present 81
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98. Slender plants with creeping stems; leaves often secund or somewhat complanate; costa none or double and short; cells narrow, prosenchymatous; alar cells 3 to 8, large, inflated and pellucid; capsule small, oval to oblong; operculum long and slenderly rostrate ..... *Rhaphidostegium, p. 326*

98. Stems round, creeping, procumbent or more or less erect, often irregularly stoloniferous; leaves ascending to appressed, often complanate, rarely secund; stem and branch leaves dissimilar in the stoloniferous species only, ovate to lanceolate, mostly slenderly acuminate; costa not often reaching the apex but usually reaching to the middle at least; cells prosenchymatous, long rhomboidal to linear-vermicular; operculum conical, blunt to long rostrate .....120 [*Brachytheciaceae*]

HYPNACEAE (99-119)

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104. Paraphyllia none or very few...106
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107. Alar cells prosenchymatous 108
108. Leaf-cells prolonged-linear ..... *Calliergon, p. 284*
108. Leaf-cells prosenchymatous-hexagonal, 2 to 6 times as long as wide. *Hygroamblystegium, p. 275*
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110. Not with above combination of characters 111
111. Leaves oval- to oblong-lanceolate, more or less long acuminate; leaf-cells narrow, prosenchymatous; plants shining..... *Homomallium, p. 274*
111. Not with characters combined as above 112
112. Plants very slender, not shining; leaves usually spreading in all directions, lanceolate to linear-lanceolate; cells rhomboidal to long hexagonal, 2 to 4, or rarely 6–8, times as long as broad..... *Amblystegiella, p. 272*
112. Leaf-cells prolonged-linear, mostly very narrow.....113
113. Leaves erect-spreading or imbricated, oblong-ovate to nearly circular, obtuse or apiculate, often very concave; costa short and double, or none..... *Acrocladium, p. 286*
113. Leaves more or less falcate-secund to circinate, from a mostly narrowed and somewhat decurrent base, becoming ovate- to triangular-or cordate-lanceolate, more or less slenderly acuminate; costa weak and reaching above the middle, or rarely even excurrent..... *Drepanocladus, p. 280*
114. Paraphyllia numerous; leaves more or less erect, from abruptly to gradually acuminate, mostly plicate. *Hylocomium, p. 298*
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115. Stem-leaves more or less crowded, imbricate, but with more or less spreading or secund tips 116
116. Stem-leaves turgidly imbricate and secund, rugose, narrowly lanceolate-acuminate from a broadly oblong base, glossy; apex distinctly serrate; cilia two; annulus present..... *Rhytidium, p. 297*
116. Stem-leaves close or loosely imbricate, not secund, broadly ovate

or rounded with an obtuse apex, olive or grayish-green, apex faintly crenulate; cilia three; annulus none. *Hypnum, p. 302*

117. Alar cells not at all or but very little differentiated; plants distantly and irregularly pinnate; leaves squarrose or spreading-secund ..... *Rhytidiadelphus, p. 295*

117. Alar cells distinctly differentiated; plants closely pinnate; leaves circinate-secund.. *Ctenidium, p. 294*

118. Plants large, to 15 cm., closely and regularly pinnate; leaves linear-acuminate from a broadly ovate base, stem-leaves plicate, falcate-secund; cilia 3 or 4..... *Ptilium, p. 303*

118. Plants large to quite slender, simple or pinnate, mostly irregularly pinnate; leaves ovate-to cordate-lanceolate, shortly to slenderly acuminate, generally circinate-secund in two series..... *Stereodon, p. 304*

119. Leaf-cells very narrowly prosenchymatous, alar cells mostly not differentiated; leaves oblong to linear, short pointed, or ovate- to linear-lanceolate, acute to long acuminate or piliferous..... *Isopterygium, p. 316*

119. Leaf-cells not so narrow, alar cells broader, hyaline and thin-walled; leaves broadly lanceolate to oval, more or less long acuminate ..... *Plagiothecium, p. 321*

BRACHYTHECIACEAE (120-126)

120. Capsule practically erect and symmetric; seta papillose; inner peristome much shorter than the outer.. *Homalotheciella, p. 330*

120. Capsule generally inclined or horizontal, unsymmetric; peristomes of equal length 121

121. Leaves with several deep sulcations..... *Camptothecium, p. 331*

121. Leaves smooth or but shallowly sulcate 122

122. Operculum conic, sometimes rostrate; alar cells differentiated..... *Brachythecium, p. 332*

122. Operculum long rostrate; alar cells few or not differentiated.....123

123. Autoicous; branches and leaves often complanate, leaves mostly only slightly concave, never sulcate, ovate to ovate—lanceolate, more or less long acuminate; costa rarely ending in a spine on the back of the leaf; cells narrow, smooth; seta smooth ..... *Rhynchostegium, p. 354*

123. Dioicous; seta generally papillose; costa sometimes ending in a spine on the back of the leaf 124

124. Leaves very concave, not at all or but weakly plicate, ovate to oblong, more or less abruptly acuminate or piliferous; costa not ending in a spine; cells narrow and smooth... *Cirriphyllum, p. 345*

124. Not with the characters combined as above 125

125. Stem and branch-leaves often dissimilar, stem-leaves ovate-to triangular-cordate or rounded triangular-oval, obtuse to somewhat acuminate; costa often ending in a spine; leaf-cells very narrow and smooth 126

125. Stem-leaves more or less concave, irregularly plicate; cells elongated-rhomboid to elongated-hexagonal; branch-leaves rough on the back by papillae or tooth-like projecting cell-angles; seta very rough ..... *Bryhnia, p. 352*

126. Leaves not or very little concave, never plicate; seta mostly rough... *Oxyrhynchium, p. 347*

126. Leaves more or less concave, mostly distinctly plicate; seta mostly smooth ..... *Eurhynchium, p. 350*

127. Mostly not aquatic, sometimes submerged but yet floating..... *Fissidens, p. 79*

127. Aquatic, filiform, and floating..... *Octodiceras, p. 86*

Order I. SPHAGNALES. Peat Mosses.

Characteristic peat mosses, in bogs, usually either in water or water-soaked, monoicous or dioicous, deeply cespitose, the tufts constantly growing upwards at the same time that the plants are dying from below and often thus giving rise to deep beds of peat, the tufts light grayish-green or sometimes yellowish, often more or less tinted with red above: stems without rhizoids, usually composed of an outer cuticular sheath consisting of one to three or four layers of large lax cells, an intermediate wood cylinder composed of prosenchymatous cells with usually thickened walls, and a central pith of lax parenchymatous cells; branches symmetrically fascicled, usually partly divergently spreading and partly slender and appressed-pendent; leaves ecostate, unistratose, composed of large, hyaline, more or less elliptic cells with usually perforated and spirally thickened (fibrillose) walls and separated by narrow chlorophyllose cells which meet at their ends to form a continuous network throughout the leaf; stem-leaves usually different in form from the branch-leaves, remote, often lacking entirely the pores and spiral fibrils, while the branch-leaves are usually porose, fibrillose, and more or less densely imbricated; seta none but the capsule is borne upon an outgrowth from the gametophyte termed a pseudopodium; antheridial flowers usually at the apex of specialized branches of the capitulum, the antheridia being pedicillate, globose, and solitary at the base of the bracts; the archegonial flowers gemmiform, axillary in one of the upper fascicles, only one of the three or four archegonia developing, as a rule: capsule globose, castaneous, with a convex operculum, without annulus or peristome; calyptra irregularly lacerate; spores developed from the amphithecium, the columella from the endothecium.

This order is a peculiar one comprising but one family (*Sphagnaceae*) which contains but the one genus (*Sphagnum*) with about 250 known species. The Sphagnums are cosmopolitan in suitable habitats but are most abundant in the cooler temperate regions of Europe and North America, in both of these countries often forming bogs of large areas. In North America there are known about 75 species, at least 20 of these occurring in our range.

I. *SPHAGNUM* [Dillenius] Hedwig.

Analytical Key to the Species.

a. Cuticular cells of the stem and usually also of the divergent branches porose and spirally fibrose; branch-leaves with a hyaline entire border, concave, cucullate, obtuse but hardly truncate. b (*Cymbifolia*).

a. Cuticular cells of the stem and divergent branches not porose nor

fibrillose; branch-leaves usually truncate and toothed or fringed, rarely acute. e.

b. Chlorophyllose cells of leaves exposed either dorsally or ventrally, or both. c.

b. Chlorophyllose cells, as seen in cross-section, centrally placed and enclosed by the hyaline cells both dorsally and ventrally. 4. *S. medium.*

c. Lateral walls of the chlorophyllose cells with fibrillose thickenings on the surfaces facing into the hyaline cells. 1. *S. imbricatum.*

c. Lateral walls of the chlorophyllose cells smooth. d.

d. Chlorophyllose cells very broadly triangular or triangularly trapezoidal with the broader face ventral. 2. *S. affine.*

d. Chlorophyllose cells narrowly triangular or trapezoidal, not over one-half as wide as long, usually less. 3. *S. latifolium.*

e. Chlorophyllose cells triangular or trapezoidal in cross-section with one or both faces free. f.

e. Chlorophyllose cells elliptical, or more or less barrel-shaped or rectangular, but not triangular nor trapezoidal. m.

f. Face of chlorophyllose cells free on the ventral surface; hyaline cells dorsally strongly convex, the interior cell-walls adjoining the chlorophyllose cells smooth. g. (*Acutifolia*).

f. Face of chlorophyllose cells dorsally free; hyaline cells ventrally strongly convex, the interior walls smooth or papillose. k.

g. Stem-leaves erose- or lacerate-fimbriate at the broadly rounded apex, non-fibrillose. 10. *S. fimbriatum.*

g. Stem-leaves not fimbriate but truncate or toothed at the apex, non-fibrillose. h.

h. Stem-leaves lingulate; plants usually reddish. 11. *S. warnstorfii.*

h. Stem-leaves more or less equilaterally triangular or triangular-lingulate. i.

i. Branch-leaves 5-seriate, when dry not lustrous. 12. *S. quinquefarium.*

i. Branch-leaves not 5-seriate, when dry sometimes lustrous. j.

j. Stem-leaves usually non-fibrillose and non-porose; branch-leaves usually lustrous when dry. 13. *S. subnitens.*

j. Stem-leaves usually fibrillose and porose; branch-leaves not glossy when dry. 14. *S. capillifolium.*

k. Hyaline cells of median dorsal leaf-surface of branch-leaves with about 5 very large pores, pores smaller towards the leaf-apex; chlorophyllose cells with the exterior walls strongly thickened. 1. (*Squarrosa*).

k. Hyaline cells with pores on median dorsal leaf-surface none or very few; chlorophyllose cells with exterior walls not strongly thickened. s. (*Cuspidata*).

l. Branch-leaves mostly squarrose in apical half of leaf. 6. *S. squarrosum.*

l. Branch-leaves slightly or not at all squarrose. 7. *S. teres.*

m. Hyaline cells of stem-leaves non-fibrillose; chlorophyllose cells of branch-leaves enclosed on both surfaces, the lumen sub-central,

elliptic; branch-leaves squarrose in their apical half. 5. *S. compactum.*

m. Hyaline cells of stem-leaves fibrillose; chlorophyllose cells of branch-leaves free on both surfaces; branch-leaves usually subsecund. n. (*Subsecunda*).

n. Cuticular sheath of stem 2-3-stratose. o.

n. Cuticular sheath of stem 1-stratose. p.

o. Stem-leaves small, not over 1 mm. long, fibrillose only towards apex; branch-leaves secund. 15. *S. laricinum.*

o. Stem-leaves large, 1.5–2.0 mm. long, fibrillose to base or nearly so; branch-leaves not secund. 16. *S. platyphyllum.*

p. Stem-leaves with hyaline border strongly widened below, fibrils none or only in upper cells. 18. *S. subsecundum.*

p. Stem-leaves with uniformly hyaline border, fibrils more numerous. q.

q. Stem-leaves strongly auriculate, large, 1.5–2.0 mm. long, fibrillose in upper two-thirds, at least, and at the base. 17. *S. gravetii.*

q. Stem-leaves non-auriculate or but slightly auriculate, usually of medium size, fibrillose in about upper two-thirds. r.

r. Stem-leaves about 1–1.5 mm. long, with septate hyaline cells and fibrillose in upper half. 19. *S. inundatum.*

r. Stem-leaves about 1.3–1.5 (–2) mm. long, very little septate, fibrillose in upper two-thirds or to middle. 20. *S. pungens.*

s. Branch-leaves about 1–2 mm. long, strongly undulate and with recurved tips when dry; dorsal pores of upper hyaline cells restricted to cell-angles. 8. *S. recurvum.*

s. Branch-leaves when dry weakly undulate, scarcely recurved, about 1 mm. long, the upper hyaline cells with pores both in the cell-angles and along the sides. 9. *S. parvifolium.*

1. **Sphagnum imbricatum** (Hornschuch) Russow.

(*S. austini* Sullivant). 26101

(Plate I)

This species occurs in bogs and wet moors in Europe and Asia and in North America from Labrador to Alaska and south to Louisiana. In our region it is represented by the following variety. The typical form, as compared with the following variety, has usually more yellowish or brownish denser tufts with the shorter comal branches more erect and the divergent branches more densely-leaved and more ascending; while the hyaline cells of the stem-leaves are only sparsely comb-fibrillose on the inside face of the lateral walls; otherwise the characters of variety and species are identical:

a. **Sphagnum imbricatum** variety **sublaeve** Warnstorf.

(*S. austini* var. *glaucum* f. *squarrosulum* Roell).

Rather densely cespitose, large, usually more or less glaucous-green, grayish or yellowish below; stems rather stout, with us about 4–8 cm. long, the wood-cylinder greenish or yellowish and surrounded by a cuticular sheath of usually

four layers of thin-walled, large, fibrillose, and porose cells, the innermost largest; stem-leaves about 1–1.8 mm. long, widely and bluntly lingulate, somewhat concave, the upper half rounded and with an erose-fimbriate margin, the base more or less auriculate; hyaline cells of stem-leaves usually non-fibrillose and non-porose, a few often septate, the upper median more or less rounded-hexagonal, the basal elongate, the insertion-cells small and brownish-incrassate; branches usually four, two or three spreading, tumid, about 1.5 cm. long, the rather shortly tapering apex pendent, the comal branches short and more or less erect-spreading, often obtuse, the pendent branches closely applied to the stem, very slender; branch-leaves 2–3 mm. long, broadly ovate, very concave, the margins involute, the apex abruptly and bluntly tapering, cucullate and more or less widely squarrose-spreading; the hyaline cells of the branch-leaves broad, fibrillose, ventrally with a few large round median pores, with small pores in the angles, dorsally with large round or elliptic pores at the cell-angles, the large pores usually equalling about one-third the width of the hyaline cell; the basal hyaline cells of the branch-leaves are distinctly comb-fibrillose on the inner lateral side of the wall adjoining the chlorophyllose cells; in cross-section the chlorophyllose cells are widely trapezoidal, the ventral wall widest and almost or quite as wide as the lateral walls, the dorsal wall exposed between the highly convex dorsal walls of the hyaline cells and usually one-third to one-half the width of the lateral wall; the cuticular sheath of the branches consisting of one layer of rectangular, fibrillose, porose cells: fruit not seen, but spores of *S. imbricatum* are stated to be yellowish, smooth, and about .025 mm. in diameter.

This variety is probably well distributed in regions where the typical form occurs.

Crawford: Pymatuning Swamp, near Linesville, May 12, 1908. O. E. J. (Figured.)

Mercer : Near Houston Junction, July 12, 1902. J. A. S.

2. **Sphagnum affine** Renauld and Cardot.

(*S. imbricatum* var. *affine* Warnstorf.)

(Plate I)

Densely cespitose, usually bluish or glaucous-green above and more or less yellowish below: stems robust, sometimes as much as a decimeter in length, usually much less, densely branched; cuticular sheath distinct, three-layered, the inner layer with the largest cells, the outer cells usually densely spirally fibrillose and 2–6-pored; stem-leaves large, 1.6–2.2 mm. long, about two-thirds as wide, widely spatulate, the rounded upper half somewhat concave, erose-fimbriate; hyaline

cells of stem-leaves usually weakly fibrillose in their upper half, porose dorsally, the hyaline cells below non-fibrillose, the pores large and few; branches usually 4, one or two of these very slender, pendent and rather closely appressed to the stem, the divergent ones horizontally spreading, with drooping tips, rather swollen below, tapering towards the apex, the branches often 2 cm. long; branch-leaves 2–3 mm. long, broadly ovate, bluntly and cucullately short-pointed, the whole leaf very concave and with more or less involute margins, the apex dorsally scabrous by the erosion of the outer cell-walls; hyaline cells of the branch-leaves rather wide, spirally fibrillose on both sides, with large well-defined pores of one-third to one-half the cell-width and confined mainly to the cell-angles; chlorophyllose cells in cross-section widely trapezoidal, the wider face being ventrally exposed and more than or at least half of the width (dorsal-ventral) of the smooth lateral walls, the dorsal face exposed and rather wide; the cuticular cells of the branches porose and densely fibrillose: fruit not seen.

In bogs and swampy borders of ponds and streams. Europe and in North America from Canada to Florida. Quite common in our region but mostly referred in the past to *S. cymbifolium.*

Beaver	: Bog 1 mile north of New Galilee, September 10, 1906. O. E. J.
Center	: In Rhododendron thicket along headwaters of Laurel Run, Tusseys Mt., July 15, 1909, and in open bog, Bear Meadows, September 21, 1909. (Figured.) O. E. J.
Clearfield	: Boggy woods, a few miles north of Cherry Tree, July 12, 1908. O. E. J.
Crawford	: In Tamarack bog near Linesville, May 12, 1908. O. E. J.; Bog near Mud Lake, Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
Jefferson	: Miss Kate Stoy.
Lycoming	: Bog near Williamsport, July 16, 1908. O. E. J.
Mercer	: Near Houston Junction, July 12, 1902. J. A. S.
Westmoreland	: Along small shaded stream, on Laurel Hill Mts., Mellon's estate, New Florence, September 8-11, 1907. O. E. J.

2a. **Sphagnum affine** forma **squarrosula** Warnstorf is a strong growing form with the upper half of the leaves of the branches when dry strongly squarrose. All gradations between the typical form and the squarrose form are to be found

in our region. A packet of specimens quite characteristically of the squarrose form is as follows:

Cambria: On boggy plateau near St. Lawrence, July 24, 1908. O. E. J.

(Mixed with *S. recurvum* Schwaegrichen).

3. **Sphagnum latifolium** Hedwig.

(*S. palustre* Linnæus; *S. cymbifolium* Ehrhart).

(Plate I)

Densely cespitose, usually robust, bluish or glaucous-green to yellowish: stems rather stout, usually 8–10 cm. long, sometimes 2–3 dm. long, the cuticular sheath composed of 3–4 layers of inflated cells, the innermost of which are the largest, the outer layer being rectangular, fibrillose and porose, the wood-cylinder being usually yellowish or brownish; stem-leaves large, about 2 mm. long and 1.25 mm. broad, sometimes 3 mm. long, spatulate-lingulate, the broadly rounded apex somewhat erose-fimbriate, below narrowly hyaline-bordered, the insertion composed of brownish and incrassate cells; lower hyaline cells of stem-leaves sometimes septate, non-porose, non-fibrillose, those of the upper one-half or two-thirds of the leaf fibrillose and porose as are the branch-leaves also, towards the apex the hyaline cells much broader relatively, often as broad as long; branches in different plants variable, 1–2.5 cm. long, more or less turgid below, acutely tapering at the apex, usually two spreading with drooping tips and two pendent and closely appressed to the stem, the comal short, ascending, more or less blunt; the branches in cross-section showing a layer of inflated cuticular cells which are rectangular, porose, and fibrillose; branch-leaves usually about 2 mm. long, sometimes 3 mm., widely ovate, very concave, the margins involute, the apex abruptly and bluntly tapering, cucullate, at back somewhat scabrous with the erosion of the outer cell-walls, when dry the leaves being more or less closely imbricate; hyaline cells of branch-leaves broad, fibrillose, ventrally porose with large lateral pores mainly confined to the cell-angles, the pores often equalling one-third the width of the cell, dorsally the pores somewhat smaller and more elliptic and lateral, mostly in the cell-angles; in cross-section the chlorophyllose cells are narrowly barrel-shaped or somewhat trapezoidal, exposed on both faces, being ventrally nearly flush with the ventral surface of the hyaline cells but the latter dorsally very convex and projecting much beyond the chlorophyllose cells, the lateral walls of the chlorophyllose cells smooth; perichætial leaves very large, broadly oval, cucullate, hyaline-bordered, rounded obtuse at apex: capsule at maturity considerably exserted above the comal tuft; spores yellow, .028–.033 mm., mature in mid-summer.

In bogs, margins of quiet rivers and lakes, wet places in woods, etc.; a cosmopolitan, occurring in North America from Labrador and Alaska south to British Columbia and Florida. In our region not uncommon.

Allegheny : Vicinity of Pittsburgh, 1902. Otto Hatry.

Crawford : Bog near Mud Lake, Hartstown, May 29-31, 1909. O. E. J. and G. K. J.

Erie : Eastern end of Cranberry Pond, Presque Isle, May 8-9, 1906. O. E. J.

3a. **Sphagnum latifolium** variety **squarrosulum** (Nees and Hornschuch) New Combination.

(*S. cymbifolium* var. *squarrosulum* Nees and Hornschuch).

As compared with the typical species this variety has usually a darker or more bluish-green color; the leaves have a more abruptly narrowed apex, the apical third of the leaf especially in the comal branches being rather abruptly squarrulose.

Probably with a world-wide distribution with the typical form but in our region more common and apparently more partial to less decidedly boggy situations.

Beaver : Bog one mile north of New Galilee, June 22, 1908. O. E. J.

Blair : Rhododendron Park, Lloydsville, October 19, 1901. J. A. S.

Center : Headwaters of Laurel Run, Tussey's Mt., near Shingletown, July 15, 1909. O. E. J.

Crawford : Pymatuning Swamp, near Linesville, August 19, 1904. O. E. J. (Fruiting specimens).

Fayette : Near Falls in crevices of rock-bed of river, Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

Indiana : Boggy banks of Cush Cushing Creek, near Cherry Tree, July 12, 1908. O. E. J.

Snyder : Bog near Richfield, July 17, 1908. O. E. J.

3b. **Sphagnum latifolium** variety **brachycladum** (Schliephacke) New Combination.

(*S. cymbifolium* var. *virescens* forma *brachyclada* Schlph.).

Bluish-green or glaucous, yellowish below; branches short and closely placed along a short stem, giving the plant a congested appearance; leaves rather loosely imbricated and at their tips slightly squarrulose.

Center : In bog at Scotia, in the "Barrens," September 22, 1909. O. E. J.

4. **Sphagnum medium** Limpricht.

(*S. cymbifolium* var. *compactum* Russow; *S. compactum* Bridel).

(Plate II)

Deeply cespitose up to 8–10 cm., gray-green to bluish-green, rose-red to purple-red above, brownish or somewhat bleached below; stems rather densely branched, the cuticular sheath consisting of 3–5 layers, distinct, the outer cells smallest, porose and weakly fibrillose, the wood-cylinder castaneous to rose-red, thick-walled; stem-leaves about 1.5 mm. long, (1–2 mm.), broadly lingulate-spatulate, the upper margins and the broadly rounded apex fimbriate; the upper hyaline cells of the stem-leaves usually fibrillose and dorsally porose; branches usually short, two slender and appressed to the stem, pendent, and two horizontally spreading or somewhat up-curved, thick-fusiform, the comal and upper more or less obtuse, the lower short-pointed; cuticular cells of branches densely fibrillose, porose; branch-leaves usually densely but sometimes loosely imbricated, 1.5–2.0 mm. long, broadly ovate, very concave, cucullate, the apex dorsally rough by erosion of the cell-walls, the margin consisting of one or two very narrow cells which are often eroded away and the edge left more or less dentate; hyaline cells of the branch-leaves rather densely fibrillose, dorsally with a few rather large pores usually confined to the cell-angles; chlorophyllose cells in cross-section small, elliptic, central, enclosed deeply on both sides by the hyaline cells, the lateral walls smooth: capsule considerably exserted; spores stated to be .024–.028 mm., somewhat rust-colored, finely punctulate.

In bogs, etc. Almost cosmopolitan; in North America occurring from Newfoundland to Alaska south to British Columbia and Florida.

Center : In a sink-hole pond in the Barrens, near Scotia, July 17 and September 22, 1909. O. E. J. (Figured).

5. **Sphagnum compactum** [Roth] Schwaegrichen.

(Plate II)

Densely cespitose, gray-green or glaucous-green, sometimes brownish above, below whitish or grayish-brown, compactly and closely short-branched: stems stout, low, in ours 4–8 cm. high, with a cuticular sheath of usually 3 layers of cells, the outermost cells largest, non-fibrillose, the wood-cylinder decidedly castaneous or sometimes yellowish; stem-leaves very small, 0.6–0.8 mm. long, broadly to equilaterally triangular-lingulate, the apex concave and broadly rounded or

truncate, erose-dentate, the margins rather widely hyaline-bordered; hyaline cells of stem-leaves broadly rhomboidal, non-porose, non-fibrillose; branches short, usually not over 1 cm. long, 3 or 4 to a fascicle, one or two thick, horizontally spreading or somewhat upcurved, the others slender and appressed-pendent; branch-leaves when dry with the upper half of the leaf more or less squarrose-spreading, large, 2–3 mm. long, ovate, concave, the margins narrowly bordered, the upper margins involute and often slightly erose-ciliate or erose-dentate, the apex erose-dentate and cucullate; hyaline cells of branch-leaves rather broadly rhomboidal, fibrillose, dorsally with several large, round pores irregularly scattered and also in the cell-angles, the pores about two-fifths as wide as the cell, sometimes a few oval and lateral, ventrally the pores small, oval, and located in the cell-angles; in cross-section the chlorophyllose cells are elliptic, enclosed both dorsally and ventrally by the moderately convex hyaline cells; cuticular cells of the branches large, short-rectangular, with one large apical pore: fruit not seen.

In bogs and wet woods, widely distributed in the Northern Hemisphere, in North America occurring from the Arctic regions south to the northern part of the United States. Rare in our region.

Center: Margin of bog under *Pinus rigida*, "Barrens," near Scotia, September 22, 1909. O. E. J. (Figured).

6. **Sphagnum squarrosum** [Persoon] Schwaegrichen.

(*S. teres* var. *squarrosum* Warnstorf; *S. crassicetum* Bridel).

Loosely cespitose, bluish- to yellow-green: stems long, loosely branched, with wood-cylinder hyaline to greenish or yellowish, cuticular sheath distinctly 2–3-layered; stem-leaves broadly oblong-lingulate, the apex broadly rounded and erose-fimbriate, the leaves very narrowly bordered, slightly auriculate, non-fibrillose, the hyaline cells above short and broad; branches 4 or 5, two or three tumid, horizontal, the leaves on the lower two-thirds of the divergent branches with squarrose tips; branch-leaves ovate-lanceolate, very concave, the apex acuminate with involute margins, margins narrowly hyaline-bordered; hyaline cells of branch-leaves richly fibrillose, on both sides with numerous large round pores of about one-half the width of the cell; in cross-section the chlorophyllose cells free on both surfaces, narrowly rectangular to trapezoidal, when trapezoidal with the wider face dorsal, the faces thick-walled, the lumen more or less elliptic, the hyaline cells strongly dorsally convex: spores yellowish and finely roughened, about .022—.025 mm. in diameter.

In usually shaded locations in swamps, boggy springs, along woodland streams, etc., in Europe, and, in North

America, from the Arctic regions to the northern part of the United States. In our region reported in Porter's Catalogue as follows:

Cambria : T. C. Porter, (Porter's Catalogue).
Huntingdon: T. C. Porter, (Porter's Catalogue).

7. **Sphagnum teres** (Schimper) Aongstroem.

(*S. squarrosum* var. *teres* Schimper; *S. porosum* Lindberg).

This species is represented in our region by a plant perhaps best regarded as the following variety, which differs from the typical form of the species mainly in having the divergent branches more or less squarrose rather than distinctly terete:

7*a*. **Sphagnum teres** variety **subteres** Lindberg.
(*S. teres* var. *subsquarrosum* Warnstorf).
(Plate II).

Weakly and loosely but quite deeply cespitose, yellowish-green to distinctly yellowish: stems up to 15 or even 20 cm. long, slender, the cuticular sheath usually three-layered, the outer cells perhaps a little the largest, non-fibrillose, usually not distinctly porose, the wood-cylinder strong, yellowish or rarely castaneous; stem-leaves large, about 1.5 mm. long, broadly lingulate, the margin narrowly hyaline-bordered, the broadly rounded to somewhat truncate apex erose-dentate, the base often slightly auriculate; hyaline cells of stem-leaves non-fibrillose, non-porose, in the lateral portions of the basal half of the leaf often septate, the upper hyaline cells about as broad as long; branches 3 to 5 to a fascicle, usually two appressed-pendent and very slender, the others widely divergent but somewhat recurved, rather slender, about 1–1.5 cm. long; branch-leaves when dry imbricate but with the apical half of some of them squarrose, the leaves usually 1.5 mm. long, ovate, concave, the narrowly hyaline-bordered margin involute towards the apex; hyaline cells of branch-leaves short, wide, both ventrally and dorsally fibrillose, and with a few large round pores about half as wide as the cell and usually located in the cell-angles; in cross-section the chlorophyllose cells in the apical third of the leaf trapezoidal to barrel-shaped and exposed both dorsally and ventrally, wider on the dorsal face, towards the base of the leaf sometimes triangular and exposed only dorsally; cuticular cells of branches rectangular and apically porose: spores not seen but said to be brownish, papillose, and about .025 mm. in diameter.

In bogs, wooded swamps, etc., in Europe and, in North America, in Canada and the northern United States, probably distributed widely with the type form. In our region known only as follows:

Crawford: In tamarack bog one and one-half miles southeast of Linesville, June 7, 1904, (Figured) and June 12, 1905. O. E. J.

8. **Sphagnum recurvum** Beauvois.

(*S. intermedium* Hoffman; *S. apiculatum* Lindberg).

(Plate II)

Loosely but deeply tufted, pale green to greenish- or whitish-yellow: stem light green, slender, long, in our region often up to 3 dm. long, the cuticular sheath rather indistinct and consisting of 3 or 4 layers of small or medium-sized rather thick-walled cells; stem-leaves small, about 0.5–0.8(–1.0) mm. long, equilaterally triangular to ovate-triangular, obtuse and slightly erose-denticulate; hyaline cells of stem-leaves rather small, mostly non-fibrillose and non-porose, towards the base on each side of the leaf more or less septate and narrowing to form a very wide border, which abruptly narrows above but reaches almost to the apex; branches usually 4, two very slender and appressed-pendent, two somewhat larger and irregularly spreading; cuticular cells of the branches elongate-rectangular, perforate and somewhat recurved at the apex, like those of the stem non-fibrillose; branch-leaves lance-ovate, imbricate, in our region ranging from 1–2 mm. long, when dry, with undulate margins, flexuose and with a recurved apex, when moist straight and erect-appressed, tapering to a rather narrowly obtuse apex with two or three teeth, the margin involute above; hyaline cells of branch-leaves fibrillose and porose, above the middle rather narrow, ventrally usually with large pores in the cell-angles of about one-third the width of the cell, dorsally with small end-pores or sometimes a very few rather distinctly ringed lateral ones; in cross-section the hyaline cells are ventrally quite convex, the chlorophyllose cells triangular or rarely trapezoidal, usually exposed only on the dorsal face; perichætial leaves large, broadly oval, concave, pointed: spores smoothish, yellow, about .025 mm. in diameter.

A cosmopolitan species occurring in North America from Newfoundland to Labrador and south to the Gulf States. In our region quite common but perhaps mainly to be regarded as belonging to the following variety:

8*a*. **Sphagnum recurvum** variety **amblyphyllum** (Russow) Warnstorf.

(*S. amblyphyllum* Russow).

The variety has the stem-leaves more distinctly spatulate-triangular, with a more rounded and somewhat erose-denticulate apex; the cuticular sheath is less plainly differentiated

and the cells are more incrassate than in the typical form of the species. All possible intergradations are represented by the specimens examined:

Cambria : Boggy plateau near St. Lawrence, July 24 1908. O. E. J.
Center : In *Rhododendron* thicket, Bear Meadows, September 21, 1909, and bogs in "Barrens" near Scotia, July 17, and September 22, 1909. O. E. J.
Crawford : Around Mud Lake, Hartstown, May 29-31, 1910. O. E. J. and G. K. J. (Figured).
Indiana : Along margin of stream near Cherry Tree, July 11, 1908. O. E. J.
Jefferson : Kate Stoy.
Mercer : Bog, Half-moon Swamp, June 12, 1906. O. E. J.

9. **Sphagnum parvifolium** (Sendtner) Warnstorf.
(*S. angustifolium* Jensen; *S. brevifolium* Roell; *S. recurvum* var. *parvifolium* Warnstorf; *S. amblyphyllum* var. *parvifolium* Warnstorf).

(Plate III)

Softly and loosely cespitose, yellowish- to grayish-green, or brownish above: stems slender, usually at least 10–12 cm. high, the wood-cylinder yellowish and without any distinctly differentiated cuticular sheath: stem-leaves small, usually 0.5–0.7 mm. long, equilaterally triangular to somewhat triangular-lingulate, the apex rounded or somewhat truncate, erose-dentate, the hyaline border narrow above and very wide below; hyaline cells of stem-leaves non-fibrillose, non-porose, a few septate towards the base on each side of the median region; branches 3–5, two being slender and appressed-pendent, two or three short, 5–9 mm. long, divergent, recurved at the tips; branch-leaves lance-ovate, about 1 mm. long, concave, the uniformly narrowly hyaline-bordered margin involute towards the narrowed, slightly truncate-erose apex, leaves when dry more or less undulate, loosely imbricate, with widely spreading or recurved tips; hyaline cells of branch-leaves narrow, fibrillose, ventrally with rounded medium-sized pores in the cell-angles, dorsally with rather smaller round pores in the cell-angles or sometimes also in rows laterally; in cross-section the chlorophyllose cells triangular and only dorsally exposed, or more usually trapezoidal and free on both faces, the dorsal face wider, the hyaline cells more convex ventrally: fruit not seen.

In bogs, swamps, etc., probably widely distributed. In North America known from Connecticut and New Jersey to Washington State. In our region known from one locality only:

Blair : Springy mountain slope, Rhododendron Park, Lloydsville, October 18, 1901. J. A. S. (Figured).

10. **Sphagnum fimbriatum** Wilson.

(*Sphagnum subulatum* Bruch).

(Plate III)

Loosely cespitose, grayish-green to yellowish-brown: stems rather slender, usually 4–5 cm. high, sometimes much longer, in cross-section showing a cuticular sheath of 2–3 layers of cells, the cells of the outer layer largest and porose; stem-leaves very widely obovate-spatulate, about 0.7–1.0 mm. long, wider above up to 0.6–0.8 mm., the upper half broadly rounded and erose-fimbriate; hyaline cells of stem-leaves non-fibrose, non-porose, very wide above the middle of the leaf, towards the base often one- to several-septate, the hyaline border towards the base widening to about one-third the width of the leaf on each side; fasciculate branches 3 or 4, usually two slender, arcuate, and decurved, and up to 2.5 cm. long, the other one or two pendent, rather closely appressed to the stem, filiform; branch-leaves closely imbricated, shortly ovate-lanceolate below to slenderly lanceolate above, concave, the upper margin incurved, the apex narrowly truncate and dentate; hyaline cells rather small with four to six fibrils, ventrally with a few round pores which are often almost as wide as the cell, dorsally with more numerous lateral pores above one-third as wide as the cell; in cross-section the chlorophyllose cells trapezoidal, free on both surfaces, the inner surface widest, the hyaline cells extending convexly considerably beyond them on the dorsal face; cuticular cells of branches without distinct necks; perichætial leaves large, obtusely ovate: spores stated to be smooth, yellowish-brown, about .025–.030 mm. in diameter.

Usually in low-lying bogs and marshes, or along the borders of streams, Europe, Asia, South America, and, in North America, from the Arctic regions through Canada to the northern part of the United States. Apparently rare in our region.

Crawford: Pymatuning Swamp, near Linesville, June 7, 1904. O. E. J. (Figured).

11. **Sphagnum warnstorfii** Russow.

(*S. acutifolium* var. *gracile* Russow).

In swampy meadows, margins of bogs, etc., in Europe and, in North America, from Newfoundland to Pennsylvania and westward to the Pacific States. The species varies from bright green to yellowish or from red to purplish. Only the green variety has thus far been found in our region, its characters being as follows:

11*a*. **Sphagnum warnstorfii** variety **virescens** Russow.

(Plate III)

Rather densely cespitose, bright green above, bleached or yellowish below: stems in our specimens from about 5–12 cm. high, the wood-cylinder green to red and surrounded by a cuticular sheath of three layers of inflated cells, the middle cells usually being the largest; stem-leaves about 1 mm. long, broadly lingulate, not auriculate, rather abruptly rounded to a narrowly erose-dentate somewhat concave apex, the margin very broadly hyaline-bordered below but abruptly narrowing above and continuing rather narrow to the apex; hyaline cells in upper half of stem-leaf broad, many of them once (or twice) septate, in the lower half of leaf the hyaline cells broad only in a narrow median strip flanked on both sides by narrow elongate cells, usually all hyaline cells of stem-leaf non-fibrillose and non-porose; fasciculate branches usually 4, two very slender and closely appressed-pendent, and two horizontally divergent, rather slender, somewhat recurved, about 1–1.5 cm. long, the comal branches short, obtuse, ascending to erect; branch-leaves rather indistinctly five-ranked, when dry with more or less spreading tips, ovate-lanceolate, concave, 1.5–2.0 mm. long, the margins uniformly narrowly hyaline-bordered and involute to the quite narrowly acuminate and truncate-erose apex; hyaline cells of branch-leaves richly fibrillose, ventrally with one or two large round median pores of one-half to two-thirds the width of the cell, these pores usually more numerous towards the margin of the leaf, dorsally with quite numerous, small, elliptic, ringed pores in the angles and along the sides of the cell; in cross-section the chlorophyllose cells narrowly trapezoidal with the ventral face wider, both faces usually free, sometimes enclosed dorsally, the hyaline cells being dorsally quite convex; the cuticular sheath of branches with long rectangular cells with indistinct necks and apical pores: spores for the species stated to be dark yellow, minutely roughened, and about .025–.030 mm. in diameter.

In our region known only from one locality, as follows:
Mercer : Near Houston Junction, July 12, 1902. J. A. S. (Figured).

12. **Sphagnum quinquefarium** (Lindberg) Warnstorf. (*Sphagnum acutifolium* var. *quinquefarium* Lindberg).

(Plate III)

Pale green or yellowish-green, mostly more or less rose-tinted above, but in our region not rose-tinted so far as yet known, deeply and densely cespitose: stems up to 10 cm., often forking, densely fasciculately branched, in cross-section

showing a yellowish or pale wood-cylinder, the cuticular sheath composed of 3 or 4 layers of large cells; stem-leaves lingulate-triangular from a wide slightly auriculate base, rather large, about 1.2–1.8 mm. long by about three-fifths as wide, rounded above to a narrowly erose-truncate apex, the margins narrowly hyaline-bordered and somewhat involute towards the apex, towards the base widely bordered; hyaline cells of stem-leaves in median basal portion and towards the apex widely rhomboid, in the upper half of the leaf septate, usually faintly fibrillose and occasionally porose, in the lateral basal portion septate, rapidly becoming very narrow outwards and merging there into the broad hyaline border; branches usually 4 or 5 in a fascicle, usually 2 or 3 widely divergent, the comal short, dense, and widely ascending to erect; branch-leaves oval to ovate, about 1.5 mm. long, concave, with involute narrowly hyaline-bordered margins, above quickly narrowed to a rather broad dentate-truncate apex; hyaline cells of branch-leaves large, fibrillose, below ventrally with a few small rounded pores in the cell-angles, the median lateral cells with a few larger indistinct pores, dorsally above with characteristic more or less elliptic pores of about one-third the width of the cell and situated in the cell-angles or along the sides; in cross-section the chlorophyllose cells rather broadly triangular, ventrally free but dorsally enclosed between the highly convex hyaline cells; cuticular cells of branches large, inflated, with a distinct neck and apical pore: spores stated to be smooth, yellowish, and about .021–.025 mm. in diameter.

In bogs, etc., in Europe and, in North America, from Newfoundland to New England and south along the mountains to the Carolinas. Rare in our region.

Clinton: Along Hyner's Run above Hyner, July 14, 1908. O. E. J. (Figured).

13. **Sphagnum plumulosum** Roell, Warnstorf.

(*S. subnitens* Russow and Warnstorf; *S. acutifolium* var. *subnitens* Dixon).

(Plate IV)

Densely cespitose, pale to grass-green, usually reddish to violet above: stem in typical specimens 10–15 cm. high, but in our region usually about 6–8 cm. high, the wood-cylinder green to red, the cuticular sheath distinct, 2–4-layered, with the outer cells largest: stem-leaves large, 1–1.5 mm. long, broadly triangular lingulate, the apex erose-truncate and toothed, the hyaline border of margin narrow above, very wide below; hyaline-cells of stem-leaves broadly rhomboidal towards the apex and in median basal portion of leaf, towards lateral basal portions rapidly much narrower and septate, all non-fibrillose and non-porose; branches 3–5 in a fascicle,

usually two of these variously divergent, rather slender, terete, about 1–1.5 cm. long, the others very slender and appressed-pendent; branch-leaves ovate, concave, about 1.5 mm. long, the narrowly hyaline-bordered margin towards the apex involute, the blade towards the apex gradually narrowed towards an erose-dentate point, the leaves when dry imbricate with more or less of a metallic lustre, not distinctly 5-seriate; hyaline cells of branch-leaves fibrillose, rather broad, ventrally with usually two or three median, large, round, ringed pores about one-third to one-half as wide as the cell, occasionally a few pores also in the cell-angles, dorsally with about 6–10 elliptic pores about one-third as wide as the cell and situated along the sides and angles of the cell; in cross-section the chlorophyllose cells small and shortly sub-rectangular to triangularly trapezoidal, situated much nearer the ventral leaf-surface with the wider ventral face free, the narrower dorsal face free or enclosed between the dorsally highly convex hyaline cells; cuticular cells of branches inflated, short, with a distinct neck and terminal pore: spores stated to be yellow, papillose, about .025–.030 mm. in diameter.

In bogs, swamps, etc., widely distributed in the cooler parts of the Northern Hemisphere, in North America occurring from Newfoundland to Alaska and south to New Jersey and Pennsylvania. In our region apparently represented only by the following variety, more properly a form, as follows:

13*a*. **Sphagnum plumulosum** variety **viride** Warnstorf.

(*S. subnitens* var. *viride* Warnstorf).

This form differs from the typical species in that the tufts are low and entirely green or often bleached out below.

In deep, shaded swamps and bogs within the range of the type.

Crawford: Shaded boggy margin of Mud Lake, Hartstown, May 29-31, 1909. O. E. J. and G. K. J. (Figured).

14. **Sphagnum capillifolium** | Ehrhart | Hedwig.

(*S. acutifolium* [Ehrhart] Russow and Warnstorf).

The typical form of this species has green to pale or variously reddish to purplish tufts with often short stout stems and a hyaline to yellowish or reddish wood-cylinder; the other characters are as described below for the variety *viride*, to which variety our single collection belongs, although in Porter's Catalogue the species is reported, as follows; under the name *S. acutifolium* Ehrhart:

Cambria : Cresson, James. (Porter's Catalogue).
Huntingdon: Warrior's Ridge, Porter. (Porter's Catalogue).

14*a*. **Sphagnum capillifolium** variety **viride** (Warnstorf) New Combination.

(*S. acutifolium* var. *viride* Warnstorf).

(Plate IV)

Rather densely cespitose, low, yellowish above, greenish to yellowish-green below, lacking the reddish tinges so often characteristic of the species: stems slender, in our region usually 5–8 cm. long, in cross-section showing a yellowish wood-cylinder and a distinct cuticular sheath of 2–4 layers of large but non-porose cells; stem-leaves oval-triangular to lingulate-triangular, 1–2 mm. long, always widest at the base, towards the apex abruptly narrowed to a truncate apex with a few teeth, the upper margin usually somewhat involute, the margin narrowly hyaline-bordered, the border sometimes wider at the base; hyaline cells of stem-leaves largely once-septate, especially below the middle, those of the upper half of the leaf usually more or less completely fibrillose and sometimes distinctly laterally porose; branches fairly numerous, usually in fascicles of four, two spreading-recurved and two appressed-pendent and very slender; the cuticular sheath of branches composed of cells with a distinct neck and terminal pore; branch-leaves 1–2 mm. long, ovate-lanceolate, when dry hardly secund but with slightly spreading tips, concave, with involute margins above, uniformly narrowly hyaline-bordered, the narrow apex somewhat erose-dentate; hyaline cells of branch-leaves rather slender, abruptly fibrillose, with small somewhat elliptic pores at the cell-angles, sometimes also lateral pores of a similar character between the angle-pores on both sides of the leaf, while towards the margin of the leaf the pores are often larger and more numerous; in cross-section the chlorophyllose cells are more or less trapezoidal, unusually short, free on both surfaces but the hyaline cells projecting far beyond them both ventrally and dorsally, especially dorsally; perichætial leaves said to be very large and broadly ovate: spores yellow, smoothish.

In boggy situations throughout Europe and North America, occurring also in Asia, South America, and in the regions of the South Pacific. In our region not common.

Fayette : In hollows along rocky river-bed above the falls, Ohio Pyle, July 4, 1908. O. E. J. (Figured).

15. **Sphagnum contortum** Schultz.

(*S. subsecundum* var. *contortum* Huebener; *S. laricinum* Spruce).

Loosely cespitose, green to brownish or yellowish, sometimes more or less purplish above: stem about 6–12 cm. high, the wood-cylinder reddish to brownish, surrounded by a dis-

tinct two-layered sheath of inflated cells; stem-leaves small, about 1 mm. long, broadly lingulate or triangular-lingulate, the hyaline border much broader towards the base, the apex broadly rounded and more or less concave, cucullate, and erose-fimbriate; hyaline cells of stem-leaves in upper third fibrillose, short and broad, ventrally with a few cells in the angles, dorsally with more numerous small ringed pores along the sides of the cell, very few of the hyaline cells septate, the lower ones long and narrow; fasciculate branches 3–5 to a fascicle, usually two slender and closely appressed pendent, two divergent and recurved; branch-leaves about 1.5–2 mm. long, broadly ovate to lanceolate, more or less sharply acuminate, the upper margin involute and narrowly hyaline-bordered, leaves when dry more or less subsecund and sublustrous; hyaline cells richly fibrillose, slender, ventrally almost poreless, dorsally with small ringed pores more or less completely arranged in bead-like rows, the pores most numerous towards upper margins of leaf; in cross-section the chlorophyllose cells narrowly barrel-shaped, with both faces free and their walls there somewhat thickened; cuticular cells of branches apically porose: spores not seen but reported as .020–.030 mm. in diameter, yellowish-brown, finely roughened.

In swampy meadows, along ditches, margins of bogs, etc., in Europe and, in North America (from New England to Eastern Pennsylvania and Ohio. Not heretofore reported from our region but a specimen collected by J. A. Shafer, October 20, 1901, at Ohio Pyle, Fayette County, is evidently very closely related to this species, differing, however, in having the stem-leaves about .7–.8 mm. long, with the margin uniformly narrowly hyaline-bordered and the hyaline cells fibrillose to below the middle of the leaf.

16. **Sphagnum platyphyllum** (Sullivant) Warnstorf.

(*S. auriculatum* Aongstroem; *S. isophyllum* Russow).

(Plate IV)

Loosely cespitose, brownish- to grayish-green: stems in our region up to 10 cm. high, slender, rather weak and sparsely branched; stem in cross-section showing a usually brownish wood-cylinder, with a distinct cuticular sheath of rather small, thin-walled, and usually uni-porose cells; stem-leaves large, usually 1.3–2.0 mm. long, oval to oblong from an auriculate base, very concave, the apex blunt and a little toothed or erose, the margin narrowly and uniformly bordered; hyaline cells of the stem-leaves in lower half to two-thirds of the leaf non-fibrillose and non-porose but some of them septate, in the upper half or one-third of the leaf the hyaline cells fibrillose and on both sides with lateral rows of small pores;

branches usually 3, sometimes 4, usually 2 spreading with recurved tips, one or two being pendent and very slender; branch-leaves broadly ovate, very concave, usually 2–3 mm. long, the apex toothed, the margin more or less incurved and with a narrow and uniform border; in cross-section the chlorophyllose cells barrel-shaped, free on both surfaces, the hyaline cells about equally convex on both sides; hyaline cells fibrillose, with numerous small lateral pores on both sides; when dry the leaves towards the base of the spreading branches more or less sub-secund; spores stated by Warnstorf to be .023–.028 mm. in diameter, yellowish and finely papillose.

In turfy swamps and bogs in Europe and North America, extending in the latter country from Massachusetts to Louisiana, also to Ohio. In our region apparently rare.

Butler : Open swampy pasture along Brush Creek, near Crider's Corners, April 26, 1908. O. E. J. (Figured).

17. **Sphagnum auriculatum** Schimper.

(*S. gravetii* Russow, p. p.—Warnstorf; *S. subsecundum* var. *intermedium* Warnstorf).

(Plate IV)

Densely cespitose, grayish or glaucous green, light yellow below: stems rather short (In our specimens about 5 cm.), densely branched; branches in fascicles 3–5, two or three of these drooping from a horizontally spreading base, terete and rather thick, up to 1 cm. long, the other one or two slender, and rather closely appressed to the stem; in cross-section the cortical cells distinct, in one layer, the outer cells of the central axis much thickened and small; stem-leaves large, 1.5–2.0 mm. long, about half as wide, concave, from the distinctly auriculate base oval-lingulate, the rounded apex narrowly toothed, somewhat cucullate, the margin narrow and of equal width from base to apex; cells of the stem-leaves fibrillose to the base or nearly so, only rarely septate, ventrally with rather large poorly defined pores in the cell-angles, rarely none, dorsally with numerous distinct pores along each side of the cell, the pores circular to elliptic and about one-fourth the width of the cell; retort cells of the branches with a distinct neck and terminal pore; lower branch-leaves large, about 2 mm. long, widely ovate, about 1.5 mm. wide, very concave, the margins more or less involute, the apex somewhat spreading, narrowly toothed, the upper leaves more closely imbricated and lanceolate; cells of branch-leaves ventrally with rather few large indistinct angle-pores, dorsally with numerous distinct pores in a row along each side, as in the stem-leaves, the hyaline cells usually with 8–10 spiral fibrils, the

border of 2–4 thick-walled, linear-prosenchymatous cells; chlorophyllose cells in cross-section barrel-shaped with both ends exposed: fruit unknown.

In wooded swamps and wet shaded places, Europe and North America. Not yet widely collected.

Fayette : In pools and wet cavities in shaded rocky bed of river near falls, Ohio Pyle, June 14, 1908. O. E. J. (Figured).

Westmoreland : On springy shaded hillside, Laurel Hill Mts., Mellon's estate, New Florence, September 9-11, 1907. O. E. J.

18. **Sphagnum subsecundum** Nees.

(Plate V)

Moderately densely cespitose, green to yellowish or brownish: stems 5–20 cm. long, with a dark or purplish-brown wood-cylinder, with a cuticular sheath of one layer of moderately inflated cells; stem-leaves small, about 0.6–0.8 mm. long, broadly short-lingulate, somewhat auriculate, the margin broadly hyaline-bordered below, the border narrowing and becoming fimbriate towards the broadly erose-fimbriate apex, the upper half of the stem-leaves often distinctly concave and more or less cucullate; hyaline cells of the stem-leaves broad above, usually all non-fibrillose, rarely a few septate, sometimes porose; of the 3–5 fasciculate branches two or three are variously divergent, short, usually 6–8 mm. long, slender and sometimes flagelliform; branch-leaves small, 1–1.5 mm. long, very concave, broadly ovate to lanceolate, acuminate to a narrowly truncate and 3–5-toothed apex, the margins uniformly narrowly hyaline-bordered, involute, when dry closely imbricate to more or less sub-secund; hyaline cells of branch-leaves narrow, richly fibrillose, ventrally non-porose, or with a few small non-ringed pores in the cell-angles, dorsally with numerous small ringed pores along the sides of the cells; in cross-section the chlorophyllose cells narrowly barrel-shaped, relatively rather large as compared with the hyaline cells, free on both faces, the hyaline cells but slightly convex on either side: spores not seen from our region, finely papillose, yellowish, and .025–.028 mm. in diameter.

In wet meadows, swamps, ditches, bogs, etc., in Europe and in Asia and, in North America, from Newfoundland to Alabama. In our region rare and approaching the variety *brachycladum* Warnstorf in having stem-leaves more or less cucullate and the divergent branches often only about 5 mm. long.

Erie : In bog at south end of Cranberry Pond, Presque Isle, May 8-9, 1906. O. E. J. (Figured).

Westmoreland: In springy places along old road, Mellon's estate, near New Florence, September 8-11, 1907. O. E. J.

19. **Sphagnum inundatum** Russow, Warnstorf.

Densely and deeply cespitose, gray or yellowish-green: stems usually 15–30 cm. long, more or less completely submerged; branches with moderately densely imbricate leaves; stem-leaves usually somewhat fimbriate at the narrow apex, little or not at all auriculate, fibrillose only above the middle; branch-leaves dorsally richly porose in lateral bead-like rows, ventrally with only a few pores located in the cell-angles. Other characters are as described for the variety *auriculatum*.

In wet meadows, wooded swamps, bogs, etc. In cooler Europe, Asia, and North America. In our region, so far as now known, represented only by the following variety:

19*a*. **Sphagnum inundatum** variety **auriculatum** (Warnstorf) Roth.

(*S. contortum* var. *laxum* Roell).

(Plate V)

Only moderately cespitose, green: stems in our specimens only about 6–8 cm. high, only occasionally completely submerged; wood-cylinder greenish, surrounded by a cuticular sheath of one (occasionally unsymmetrically two) layer of inflated more or less distinctly porose cells; stem-leaves 1.2–1.5 mm. long, about three-fifths as wide, distinctly auriculate, towards the apex somewhat concave, the margins narrowly uniformly hyaline-bordered and toward the apex involute, the narrow apex somewhat dentate but not fimbriate; the hyaline cells of stem-leaves broad, towards the lateral portions of the base becoming narrower, usually septate, fibrillose at least as far down as the middle of the leaf, or farther, and usually also fibrillose at the base of the leaf, above ventrally with rather small distinct pores in the cell-angles and usually other less distinct lateral pores, above dorsally with small pores in cell-angles and numerously along the sides of the cells; of the usually 5 fasciculate branches two are pendent and the others short, usually 6–9 mm. long, variously widely divergent; branch-leaves when dry very lax and widely divergent, 1.5–2 mm. long, ovate, very concave, with involute, narrowly and uniformly hyaline-bordered margins, the apex narrow and dentate-truncate; hyaline cells of branch-leaves rather long and slender, richly fibrillose, dorsally with laterally-placed bead-like rows of small pores about one-fifth as wide as the cell, ventrally with small ringed pores in the cell-angles, occasionally also a few laterally arranged indistinct pores; cuticular cells of branches large with a short neck and terminal pore; in cross-section the chlorophyllose cells narrowly elliptic

with about equally free and thickened faces: for the type of the species the spores are stated to be yellow and about .030–.035 mm. in diameter; of the variety the spores have not been seen.

Center : Headwaters of Laural Run, Tussey Mt., above Shingletown, July 15, 1909. O. E. J.

Fayette : In pools and wet crevices in rocky bed of river above falls, Ohio Pyle, September 1-4, 1906. O. E. J. and G. K. J. (Figured).

20. **Sphagnum pungens** Roth.

(*S. contortum* var. *gracile* Roell).

(Plate V)

Rather loosely cespitose, bluish-green, when dry sub-lustrous above, yellowish or brownish below: stems rather stout, often forking, in our specimens up to 6 or 7 cm. high; wood-cylinder greenish or pale, enclosed in a one-layered cuticular sheath which in places is unsymmetrically often two-layered; stem-leaves broadly lingulate, about 1–1.5 mm. long, at base about three-fifths as wide, somewhat auriculate, the uniformly narrowly hyaline-bordered margin somewhat erose-fimbriate towards the broadly rounded erose-dentate apex; the hyaline cells of stem-leaves broad, rarely septate, distinctly fibrillose in upper two-thirds of leaf, ventrally with a few indistinct pores in the angles and along the sides of the cell, dorsally with numerous small pores arranged in lateral bead-like rows; of the usually 4 fasciculate branches, two are slender and appressed-pendent while the other two are horizontally divergent and recurved, about 1–1.5 cm. long, the lower and median leaves of the divergent branches more or less widely squarrose, the upper ones imbricate so that the branch ends in a sharply acuminate point; branch-leaves broadly ovate to lanceolate, large, 1.8–2.6 mm. long, concave, the uniformly narrowly hyaline-bordered margins involute towards the acuminate few-toothed apex; hyaline cells of branch-leaves narrow, long, richly fibrillose, ventrally with a few indistinct pores in the cell-angles, dorsally with numerous small ringed pores about one-fourth to one-fifth as wide as the cell and arranged in bead-like rows along the sides of the cell; in cross-section the chlorophyllose cells relatively large, narrowly barrel-shaped, free on both faces, the hyaline cells not being markedly convex on either face; cuticular cells of branches long-rectangular with a short neck and a large apical pore: spores not known from our region.

A more or less intermediate species between *S. inundatum* and *S. auriculatum*. Heretofore reported, so far as known to the

present writer, only from Europe, where it occurs in swampy meadows.

Center : Bog in sink-hole, in pine-barrens near Scotia, July 17, 1909. O. E. J. (Figured).

Order II. *ANDREAEALES.*

Small, monoicous (or dioicous), dark brown to almost black, when dry very brittle, mostly cespitose on granite or slate rocks: stems slender, radiculose below, dichotomous, with fascicled branchlets, no central strand; leaves small, crowded, erect-spreading to often falcate-secund, uni-stratose to partly bi-stratose, thickish, often more or less papillose, costate to ecostate, very opaque; cells small, incrassate: seta none, but represented by a pseudopodium from the gametophore; capsule oval, opening by 4 (–8) vertical slits, the valves remaining united both above and below; spores and columella derived from the endothecium; no air-cavity between the spore-sac and the capsule-wall; calyptra torn at the base, delicate; spores large, about .034 mm. in diameter, chlorophyllose.

This peculiar order is represented by but one family, the *Andreaeaceae,* which consists of only one genus, *Andreae* [Ehrhart] Hedwig. There are about 90 species, alpine or sub-alpine and widely distributed; 13 species occur in North America, only 3 of which, however, are to be expected in our range.

1. *ANDREAEA* [Ehrhart] Hedwig.

a. Leaves ecostate. 1. *A. rupestris.*
a. Leaves costate. b.
b. Leaf elongate-lanceolate; costa filling only about the middle one-third of the leaf-apex. 2. *A. rothii* Weber and Mohr.
(*A. rupestris* Roth).
b. Leaf lanceolate-subulate; costa practically filling the whole apex of the leaf. 3. *A. crassinervia* Bruch.

1. **Andreaea rupestris** Hedwig.

(*A. petrophila* Ehrhart).

Densely cespitose, dark brown to blackish: stems slender, about 1.5–2.5 cm. high, usually branching, more or less erect; leaves when dry very brittle, crowded, small, ovate to lance-ovate, imbricated, often falcate-secund from an erect base, usually obtuse, entire, margin incurved; no costa; (the leaves are so dense that they usually require bleaching in a solution of caustic potash before the leaf-cells can be made out under the microscope); basal leaf-cells narrow-rectangular, very incrassate, sinuose, above becoming shorter, the median and upper cells rounded and angular-oblong, longitudinally seriate, dorsally strongly papillose: fruit similar to that of *Sphagnum* in being enclosed in the perichaetium until mature, when it is quickly exserted on an outgrowth from the tip of the leafy shoot similar in appearance to a short seta and termed the pseudopodium; calyptra very thin and irregularly torn at base;

capsule oval, opening usually by four perpendicular slits along the sides but remaining united at apex and base; columella persistent; spores smoothish, mature in late spring.

Cosmopolitan in mountainous or hilly regions on non-calcareous exposed or dry rocks. In North America from the Arctic regions south to northern United States. Occurs in northeastern Pennsylvania and in northern West Virginia.

Order III. *BRYALES.* True Mosses.

This order comprises numerous mosses of various habit: the endothecium gives rise to the sporogenous tissue, which surrounds an inner sterile tissue, loose in *Archidium,* but forming the columella in the rest of the *Bryales;* the spore-sac is separated from the wall of the capsule by a more or less highly developed air-cavity; there is no pseudopodium but there is a more or less elongated true seta; the outer wall of the archegonium after some growth is ruptured, thus forming a basal vaginule and an apical calyptra; capsule cleistocarpous or, more usually, with a definite operculum and then often with a single or double peristome: the order is conveniently divided, according to the position of the sporogonium upon the leafy shoot of the gametophyte, into the *acrocarpous* mosses (sporogonium at the apex of the leafy shoot) and *pleurocarpous* mosses (sporogonium lateral upon the leafy shoot).

Acrocarpi.

The acrocarpous mosses comprise about thirty families of the Bryales widely distributed and numerous in number of species. For the analytical key to the acrocarpous mosses see the general key to the genera of mosses at the beginning of the book, p.

Family I. *ARCHIDIACEAE.*

Autoicous, sometimes paroicous or synoicous, rarely dioicous: small terrestrial plants, closely gregarious and forming broad mats; stems erect, with central strand, below bearing rhizoids; leaves of the shoots and also the basal leaves minute, spreading, distant, linear-lanceolate, acuminate, flat, entire, the costa ending in the point; perichætial leaves much larger, imbricated, more or less linear-acuminate from a lanceloate base; leaf-cells smooth, prosenchymatous or sometimes sub-vermicular to parenchymatous: capsule sessile, spherical, terminal, non-operculate; columella none; spores commonly 16—20, about .200 mm. in diameter.

One genus only, the characters being as given for the family, comprising about 26 species, distributed widely in the temperate zones. Six species are native in North America, but only one is likely to be collected in our region.

1. *ARCHIDIUM Bridel.*

1. Archidium ohioense Schimper.

Occurs on the ground in meadows and fields throughout eastern United States from New Jersey to Kansas and from Minnesota to Louisiana. Not yet reported in our region, but to be expected, as it occurs in eastern Pennsylvania and in Ohio.

Family II. *DICRANACEAE.*

Autoicous or dioicous; large to minute, mostly cespitose: stem with a central strand, often thickly covered with rhizoids, mostly densely leafy, branched; leaves often falcate-secund, mostly acuminate to narrowly linear from a broader base, usually more or less smooth and shining, usually costate; costa sometimes dorsally serrate, heterogenous; leaf-cells sometimes mammillate, the basal ones enlarged and mostly transparent, alar cells often much larger and either hyaline or brownish, the central leaf-cells short to rounded, mostly smooth; perichætial leaves often sheathing: seta usually erect and long; capsule mostly unsymmetric, usually cernuous, when dry often curved and sulcate; annulus present or absent; peristome simple or rarely none; when present the peristome teeth are 16 in number, approximate, united below into a basal membrane, usually two-parted to the middle, or beyond, into linear or awl-like divisions, no longitudinal lines, but the teeth minutely striate or papillose on the dorsal face, rarely smooth, inner face yellow with one or two longitudinal lines and with more or less projecting trabeculæ; operculum more or less long-rostrate; calyptra usually cucullate.

Key to the Genera.

a. Cells of costa in cross-section homogeneous; peristome-teeth broad, flat, undivided, mostly smooth, rarely none. 6. *Seligeria.*

a. Cells of costa as seen in cross-section heterogeneous; teeth narrow, prolonged, mostly two-parted, striate or papillose. b.

b. Alar cells not differentiated. 1. *Bruchia.*

b. Alar cells differentiated. c.

c. Cells of the lamina smooth. d.

c. Cells of the lamina mamillate on the free surfaces. j.

d. Capsule mostly long-necked; stomata numerous in the neck or in middle of capsule-wall. e.

d. Capsule with a short neck or none; stomata few or none. g.

e. Calyptra mitrate; operculum either not deciduous or else not differentiated. f.

e. Calyptra cucullate; operculum deciduous. 2. *Trematodon.*

f. Capsule immersed, erect, without a neck, apiculate. (*Sporledera*)

f. Capsule immersed or slightly exserted, with a distinct neck, more or less cernuous, rostrate. 1. *Bruchia.*

g. Capsule mostly unsymmetric, not erect. 7. *Dicranella.*

g. Capsule symmetric and erect. h.

h. Operculum not differentiated. 3. *Pleuridium.*

h. Operculum differentiated. i.

i. Upper areolation rounded-quadrate: capsule plicate or furrowed, nor plicate. 4. *Ditrichum.*

i. Upper areolation more or less elongate: capsule neither furrowed nor plicate. 5. *Ceratodon.*

j. Capsule with 8 furrows and 8 ridges; leaf-cells not mammillate. 8. *Rhabdoweisia.*

j. Capsule not furrowed nor ridged; leaf-cells strongly mammillate. 10. *Oreoweisia*

k. The 16 peristome-teeth cleft only to about the middle. 1.

k. The 16 peristome-teeth cleft to the base; alar cells reaching to the costa. 13. *Dicranodontium.*

l. Peristome-teeth united at base to form a tube, deeply inserted; capsule strumose. 9. *Oncophorus.*

l. Peristome-teeth not forming a tube, only slightly inserted; capsule rarely strumose. 10. *Dicranum.*

1. *BRUCHIA* Schwaegrichen.

Autoicous or paroicous; gregarious: green protonema persistent but sparse; stem short with a central strand; leaves long-canaliculate-subulate, from an oval to lanceolate base, erect to secund; costa broad and flat, filling the subulate acumen; laminal cells rectangular; seta short; capsule pyriform, immersed or slightly exserted, with a more or less long neck, more or less cernuous, rostrate; operculum none; calyptra covering one-third or more of the capsule, mitrate, unsymmetrically cleft.

A widely distributed genus of about 25 species, 14 of these being found in North America, two of the latter probably occurring in our region.

Key to the Species.

a. Capsule ovoid-pyriform, collum very short. 1. *B. flexuosa.*

a. Capsule ovoid-oblong, collum a little longer. 2. *B. sullivantii.*

1. **Bruchia flexuosa** (Schwaegrichen) Mueller.

Gregarious, the green protenema persistent but not very conspicuous: stems about 2–4 mm. long, curved to erect; leaves remote, small, lance-subulate, erect-spreading from a concave base, somewhat serrulate at the apex; leaf-cells long-rectangular, sub-papillose, alar not much different; antheridia in axils of comal leaves or in separate buds; seta short, stout, usually shorter than the erect, ovoid-pyriform, partially exserted, apiculate capsule; calyptra narrowly conic, mitrate; spores decidedly papillose, mature in May or June.

On clay soil in fields from Minnesota to New England and south to the Gulf States. Occurs in eastern Pennsylvania and in Ohio and is to be expected in our range.

2. **Bruchia sullivantii** Austin.

Very close to *B. flexuosa*, from which it differs mainly in having shorter stems; the leaves narrowly lance-ovate, smooth or nearly so; the leaf-cells shorter rectangular; the capsules with a short and rather inconspicuous collum and altogether more nearly ovoid-oblong than pyriform.

On clay soil in fields from New England to Missouri, south to the Gulf States. Occurs in eastern Pennsylvania and in Ohio and so is to be looked for in our range.

2. *TREMATODON* Richard.

Autoicous, rarely dioicous; low, singly disposed: stem with a large central strand and loose ground-tissue; leaves yellowish-green, narrow, abruptly to gradually lance-subulate, more or less crisped when dry; costa ending below the apex or percurrent; cells thin-walled, loosely elongate-hexagonal to rectangular or, above, rhombic-pentagonal or -hexagonal: seta yellow, erect, rarely tortuous to cygneous; capsule with a more or less long tapering neck, moderately arcuate, the urn smooth; annulus differentiated; peristome-teeth united below into a low basal tube, undivided and cribrose or two-parted to the base into filiform divisions, peristome rarely lacking; operculum as long as the urn, obliquely rostrate; calyptra inflated, cucullate, not ciliate.

A cosmopolitan genus of about 70 species, of which about 20 occur in North America, 2 of these in our region.

Key to the Species.

a. Collum as long as urn of capsule. 1. *T. ambiguus.*
a. Collum twice as long as urn. 2. *T. longicollis.*

1. **Trematodon ambiguus** [Hedwig] Hornschuch.

Densely cespitose, light green to brownish-green: stems short, up to 1–2 cm. high, sparsely branched, erect to ascending; leaves abruptly linear-subulate from a concave ovate base, flexuous, erect-spreading, the acumination canaliculate, serrulate at extreme apex; costa narrow, percurrent; basal leaf-cells laxly long-hexagonal-rectangular, hyaline, quickly narrowed above, in the subulation becoming small, irregularly quadrate, chlorophyllose and, especially towards the apex, quite obscure, in the apex the lamina forming a very narrow and obscure margin along the costa; perichætial bracts larger and somewhat gradually acuminate: seta bright yellow, lustrous, 1–3 cm. long, flexuous; including the neck the capsule is clavate, arcuate-cernuous, bright orange-red; the neck and urn are each about 2 mm. long, the neck linear-cylindric, somewhat strumose at base on inner side, the urn narrowly oblong- to pyriform-cylindric; peristome-teeth 16, cleft or irregularly perforate, confluent at base; operculum about 1.5 mm. long, obliquely subulate-rostrate; annulus large, revoluble; autoicous, the antheridial cluster terminal on a basal branch: spores large, minutely roughened, mature in summer.

In old fields and meadows, often in wet sandy places, in Europe and, in North America, from Canada to the northern United States.

Cambria: Cresson. *James* and *Porter.* (Porter's Catalogue).

2. **Trematodon longicollis** Richard.

Cespitose, light green to brownish-green: stems erect, usually about 5 mm. high; leaves abruptly linear-subulate from a concave ovate base, the subulation canaliculate, minutely serrulate at apex; costa percurrent; leaf-cells as in *T. ambiguus;* perichætial leaves quite gradually long-acuminate: seta similar to *T. ambiguus;* collum twice as long as the urn; urn more strictly oblong-cylindric; peristome-teeth 16, narrow-subulate, nodosely articulate, usually perforate rather than cleft. Otherwise very similar to *T. ambiguus.*

In old fields, etc., on sandy or clayey soil, in Europe, Asia, and, in North America, from New Jersey, Pennsylvania, and Ohio southwards. Not yet reported in our region, but to be expected.

3. *PLEURIDIUM* Bridel.

Autoicous or paroicous, rarely synoicous: weak, green or yellowish-green, cespitose or gregarious: stem with a central strand, radiculose at base, perennial by means of fertile shoots below the apex and by means of sterile flagella; leaves mostly terminal, erect-spreading, sometimes secund, linear-subulate from a broader base, upwards weakly denticulate, sometimes thickly imbricated; costa varying from weak and ending below the apex to very broad and filling the whole acumen, often rough-serrate dorsally; seta mostly very short and erect, rarely curved; capsule mostly immersed and oval to ovate-globose, short pointed, sometimes obliquely so, cleistocarpous, without a collum; calyptra cucullate, cleft almost to the apex on one side, covering scarcely half the capsule.

About 30 species widely distributed, mainly in temperate regions, on soil. Seven species occur in North America, at least two in our region.

Key to Our Species

a. Perichætial leaves long and gradually subulate from a small oval base; antheridia naked in the axils of the perichætial leaves. 1. *P. subulatum.*

a. Perichætial leaves abruptly long linear-subulate from an oval base: antheridia gemmiform in the axils of the upper leaves. 2. *P. alternifolium.*

1. **Pleuridium subulatum** [Hudson] Rabenhorst (*Phascum subulatum* Hudson).

Densely gregarious to cespitose, yellowish-green: stems usually simple, about 2–5 mm. high; stem-leaves lance-ovate, the lower shorter and more nearly ovate; comal and perichætial leaves much longer, more or less erect or subsecund, from a

small oval base gradually subulate-setaceous, nearly entire to minutely denticulate; costa wide, not well defined, practically filling the apex; basal leaf-cells rectangular to more or less oblong-hexagonal, the upper cells often becoming linear and forming a more or less distinct margin to the costa: seta short, erect; capsule oval or roundish, small but longer than the seta, minutely obtusely apiculate, more or less castaneous or yellowish when mature; calyptra cucullate, reaching about halfway down the capsule, short rostrate, split almost to apex; spores large, mature from April to June: antheridia naked in axils of the perichætial leaves.

On moist clayey or sandy soil in old fields, along banks of ditches, etc., in Europe, Asia and in North America, from New England to Wisconsin and south to Alabama.

Washington: *Linn & Simonton.* (Porter's Catalogue).

2. **Pleuridium alternifonum** [Dickson; Kaulfuss] Rabenhorst.

Densely cespitose, yellowish-green: stems about 5 mm. high, simple, or longer with flagelliform innovations up to 2 cm. or more long; stem-leaves lance-ovate to lanceolate, about 1 mm. long, the comal and perichætial abruptly much longer; costa ending in the apex: basal leaf-cells rhomboidal or rectangular, above rectangular, small, moderately incrassate; perichætial leaves up to 3 or 4 mm. long, abruptly narrowed from an oval base to a long linear-subulate acumen which consists largely of the excurrent costa and is finely and closely denticulate-muricate, the costa at base is broad and indistinct: seta very short, erect; capsule oval, at apex obliquely conic-apiculate, immersed, yellowish to brownish, cleistocarpous; calyptra small, cucullate, split almost to apex; spores large, minutely roughened, mature in spring or early summer: autoicous, antheridial clusters gemmiform in axils of upper leaves.

Sandy fields, roadsides, banks of ditches, etc., in Europe, southwestern Asia, and in central and eastern United States. Since this *Manual* went to press the species has been unexpectly found as follows:

Butler : In sandy meadow on south slope of hill two miles southwest of Glade Mills, April 20, 1913. O. E. J. and A. R. Hillard.

Westmoreland: In sandy-clay meadow on gently sloping hillside east of Blackburn, April 24, 1913. O. E. J., G. K. J., and R. J. Sim.

4. *DITRICHUM* [Timm] Hampe.

Dioicous or autoicous; mostly low, cespitose, not radiculose, green to yellow-green, more or less shining: stem with a central strand, densely foliate, simple or little branched; leaves with a broad base, not sheathing, mostly long-canaliculate-

subulate, imbricated to erect-spreading or secund, when dry mostly a little curved or straight; costa broad and flat, percurrent or excurrent, usually filling the upper part of the acumen; leaf-cells rectangular, more or less prolonged: seta elongate, erect; capsule erect or a little cernuous, symmetric or unsymmetric, sometimes weakly arcuate, mostly ovate to oblong-cylindric, sometimes sulcate; peristome with a basal membrane, teeth mostly cleft to the base or nearly so into two linear-filiform portions, papillose, rarely weakly twisted to the left; articulations not projecting dorsally, sometimes coupled at the base of the teeth; annulus mostly serrate, revoluble; operculum mostly obliquely conic; calyptra reaching to below the middle of the capsule. .

A cosmopolitan genus of about 72 species, mostly growing on soil, about 20 species in North America, 3 of these occurring in our region.

Key to the Species.

a. Dioicous: perichætial leaves more or less sheathing. b. 3. *D. pallidum.*

a. Autoicous.
  b. Capsule somewhat unsymmetric, subsulcate, somewhat cernuous. 1. *D. vaginans.*
  b. Capsule symmetric, smooth, erect. 2. *D. tortile.*

1. **Ditrichum vaginans** (Sullivant) Hampe.

(*D. tortile* var. *vaginans* Grout; *Trichostomum vaginans* Sullivant; *Leptotrichum vaginans* Schimper.)

(Plate V)

Densely cespitose, yellowish-green, lustrous: stems erect, ascending, about 5 mm. high, usually with erect terete sterile branches, sometimes up to 1.5 cm. high; leaves 1–1.5 mm. long, close, erect-appressed when dry, not much spreading when moist, from an ovate concave base narrowed to a linear deeply canaliculate acumination, margins narrowly recurved, usually entire; costa strong, percurrent or rarely excurrent, comprising from one-third to one-half of the width of the acumination; upper leaf-cells rectangular, mostly about 2:1, rather dense and incrassate, smooth, the basal larger, elongate-rectangular up to 6–8:1, moderately thin-walled, sub-hyaline or yellowish; perichætial leaves larger, convolutely sheathing, above narrowing abruptly into a linear-subulate, canaliculate, entire acumination, the basal cells larger and laxer than in the stem-leaves: seta erect, flexuous, lustrous, yellowish to brownish, sinistrorse, about 1–2 cm. long; capsule brownish, about 1.5 mm. long, narrowly to oblong-cylindric, rounded at base, little changed when old; lid about one-fourth the length of the urn, conic-rostellate obliquely, castaneous; annulus 2–3-seriate, wide: peristome-teeth linear subulate, imperfect, forked to the

base or often united above, or irregularly cleft, deep castaneous, articulate; exothecial cells yellowish-incrassate, irregularly oblong to rectangular, the 4 or 5 uppermost rows much smaller, rounded and obscure; calyptra cucullate, covering about one-half of the capsule; spores yellowish, smooth, about .015–.018 mm., maturing in late fall or winter.

Usually on sandy soil in hilly or mountainous districts. In Europe, and in North America, from Maine to Missouri and North Carolina. Not common in our region.

Allegheny: Powers Run, September 14, 1905. (Figured). O. E. J. and G. E. K.; Wildwood Road, March 29, 1908. O. E. J. and G. K. J.; Thornhill, December 29, 1908. O. E. J.

McKean : West Branch, September 6, 1896. D. A. B.

2. **Ditrichum tortile** [Schrader] Brockmueller.

(Plate VI)

Cespitose, yellowish-green, rather dull: stems short, about 5–10 mm. high, erect or erect-ascending from a radiculose base, mostly simple, reddish; leaves about 2.5–3.5 mm. long, closely appressed-erect to somewhat spreading, usually somewhat secund or twisted, gradually lance-subulate and canaliculate from an ovate-lanceolate concave base, margins more or less narrowly revolute, apex usually denticulate; costa strong, less distinct at base, in the upper portion constituting about one-third to one-half of the leaf-width, percurrent to slightly excurrent; basal cells rectangular to linear-rectangular, alar not different, rather thin-walled and hyaline, smooth, median smaller, mostly about 2:1, rectangular to quadrate, smooth, the apical sometimes bi-stratose; perichætial leaves more or less sheathing, otherwise similar to the stem-leaves: seta reddish-brown. shining, somewhat sinistrorse, erect, about 1 cm. long; capsule oblong to oblong-cylindric, reddish to pale brown, smooth, non-sulcate, not constricted below the mouth, abruptly narrowed to the seta at base, the urn about 1 mm. long; annulus uni-seriate; peristome single, rather low, reddish, the 16 teeth cleft into linear-subulate, distinctly trabeculate, somewhat spirally twisted divisions, at base united into a very low membrane; operculum conic-rostellate, usually more or less oblique; calyptra cucullate, pale; spores rather thin-walled, smooth, yellowish-pellucid, about .015–.018 mm., mature in late fall or in winter: dioicous.

Not uncommon on clayey soil in fields, along roadsides, etc., in Europe, Asia, northern Africa, and in the eastern half of North America from Labrador to the Gulf States. Not very common in our region.

Allegheny: On wet clay in old quarry, Library P. O., April 8, 1906, on dry rocky hillside, Powers Run,

April 18, 1906; Keown, November 14, 1909. (Figured). O. E. J.; on clay bank, Wildwood Road, November 19, 1908. O. E. J. and G. K. J.

3. **Ditrichum pallidum** [Schreber] Hampe.

(Plate VI)

Loosely cespitose, bright green; stems about 5 mm. high, more or less erect, or with a creeping base; leaves erect-spreading, sometimes somewhat secund, from a lance-ovate base, prolonged linear-subulate, concave, channeled towards the apex; costa strong, long-excurrent, denticulate towards the apex; basal leaf-cells laxly oblong-hexagonal, thin-walled, hyaline, up to about .015–.017 mm., the median cells gradually much smaller, rectangular, forming but a narrow margin to the costa; seta erect, yellow, slender, dextrorse and flexuous when dry, about 1–2 cm. long; capsule ovate-oblong, yellowish-red, ascending to horizontal, somewhat unsymmetric, usually somewhat strumose at base, about 2 mm. long, when dry and empty sub-arcuate and irregularly sulcate; peristome single, the 16 teeth bifid deeply, united at base into a very low basal membrane, the prongs cylindric, nodose-articulate, finely papillose, reddish, about 0.5 mm. long; annulus compound, deciduous, bordered by two or three rows of small, rounded, reddish-pellucid cells; spores globose, papillose, about .017 mm., reddish-pellucid, mature in early summer; operculum conic-obtuse, about 0.6 mm. long; calyptra smooth, cucullate, slenderly straight-rostrate, about 2.5 mm. long, the beak reaching about 1.5 mm. beyond the tip of the operculum; antheridial clusters gemmiform in axils of the perichætial leaves.

On bare soil, usually in woods. Europe, Asia, northern Africa, and, in North America, from Ontario to the Gulf of Mexico and westward to Kansas. Very common in our region.

Allegheny : Sandy Creek, May 8, 1904, Powers Run, May 10, 1905, Fern Hollow, Pittsburgh, June 18, 1907, and Douthett, December 29, 1908. O. E. J.; Moon Township, April, 1902. J. A. S.

Armstrong : Whiskey Hollow, West Kittanning, August 26, 1903. J. A. S.

Beaver : Beaver Falls, May 11, 1907. O. E. J.

Center : Barrens, near Scotia, July 14, 1909, Tussey's Mountain, near Shingletown, July 15, 1909, and Matternville, September 20, 1909. O. E. J.

Crawford : Linesville, June 11, 1908. O. E. J.

Fayette : Ohio Pyle, May 30-31, 1909. O. E. J.;

Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
Lawrence : New Castle, 1906. Miss Susan Gageby.
McKean : Toad Hollow, Bradford, June 17, 1896, and Bennett, May 30, 1897. D. A. B.
Washington : Spier Station, May 20, 1907. O. E. J.
Westmoreland : Laurelville, May 30-31, 1903. J. A. S.; Blackburn, June 13, 1908. (Figured).

5. *CERATODON* Bridel.

Dioicous, rarely autoicous; cespitose, green to brown or reddish-brown, somewhat radiculose; stem 3–5-angled, with a central strand, thickly foliate, often bushy-branched; leaves erect-spreading, appressed and more or less twisted when dry, ovate to lance-linear, neither sheathing nor subulate-pointed, margin revolute; costa strong, percurrent or long-excurrent, with median guides; leaf-cells thick-walled, short-rectangular below, the upper quadrate to rounded, smooth; perichætial leaves distinctly sheathing; seta long and erect; capsule inclined to horizontal, elliptic-ovate to oblong, purplish to reddish-brown, shining, when dry sulcate; annulus spirally deciduous, 2—4-seriate; peristome-teeth 16, cleft nearly to the base into filiform divisions, united at the base into a tube, the teeth closely articulated below, less closely above, papillose; operculum conic, much shorter than the capsule; calyptra cucullate.

A cosmopolitan genus consisting of 27 species; 7 species in North America, only one occurring in our region.

1. **Ceratodon purpurascens** (Hedwig) New Combination.
(*Mnium purpureum* Linnæus; *Dicranum purpurascens* Hedwig; *Ceratodon purpureus* Bridel).

(Plate VI)

Densely and often rather deeply brownish- or reddish-cespitose, mostly green above and dark brown below: stems mostly branched, erect, about 1 cm. high, dying away below; leaves lanceolate to linear-lanceolate, carinate, the margins revolute to near apex; costa strong, percurrent, at base about one-sixth to one-fourth the width of the leaf; seta about 1.5 cm. long, erect, dark-castaneous, lustrous, twisted when dry; capsule oblong-linear, at first erect, later inclined to horizontal and more or less curved, irregularly sulcate, strumose, about 2.5 mm. long, dark red-brown, lustrous, annulus distinct, revoluble; peristome-teeth dark red below, basally confluent, papillose, weakly trabeculate to a little above the middle, bordered, hyaline above; operculum conic-elongate, about one-fourth the length of the urn, often somewhat curved, usually darker brown than the urn; calyptra cucullate; exothecial cells

rather incrassate, irregularly elongate-hexagonal or rectangular-oblong, two or three rows at the rim much smaller and darker; spores smooth, rather thin-walled, yellowish-pellucid, mature in May or June.

Cosmopolitan on burnt-over ground, roadsides, vacant lots, roofs, bare clay soil, etc. Very common in our region.

Allegheny : About 20 different collections examined from various localities.
Beaver : Beaver, April, 1902. Miss Anna M. Deens.
Butler : Buffalo Creek, near Winfield Junction, May 26, 1906. O. E. J.
Cambria : Cresson, May 18, 1904. O. E. J.
Center : Barrens, near Scotia, July 16, 1909, and on Bald Eagle Ridge, near Matternville, September 20, 1909. O. E. J.
Clinton : Lock Haven, July 15, 1908. O. E. J.
Crawford : Linesville, June 6, 1904, May 10-11, 1906, June 11-12, 1907, and May 12, 1908. O. E. J.; Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
Erie : On sand-plain, Presque Isle, May 15 and June 10-11, 1905, and May 8-9. (Figured) and September 20-22, 1906. O. E. J.
Fayette : Ohio Pyle, June 14, 1908. O. E. J.
Lawrence : Graceland Cemetery, New Castle, Miss Susan Gageby; in gorge below Ellwood City, June 26, 1909. O. E. J.
McKean : Langmade, April 26, 1896. D. A. B.
Somerset : Ursina, May 12, 1905. O. E. J.
Washington : Hanlin, May 21, 1907, and Charleroi, April 24, 1908. O. E. J.
Westmoreland : Hillside, May 19, 1906, and May 22, 1909, "Shades," near Blackburn, June 13, 1908. O. E. J.

6. *SELIGERIA* Bryologia Europæa.

Autoicous: minute, gregarious, or cespitose, rupestral: stem simple or branched at base, rarely with long sterile shoots; leaves in 3 to 5 series, the lower minute and distant, the upper abruptly larger and canaliculate-subulate from a concave lanceolate base; costa often stronger above the base; alar cells not differentiated: seta mostly erect, but little longer than involucral leaves; capsule globose-pyriform, smooth; collum distinct; annulus none; peristome deeply inserted, or rarely none; when present, teeth broadly lanceolate, usually entire, truncate or acute; operculum obliquely rostrate; calyptra cucullate.

A widely distributed genus of about 15 species; 4 occurring in North America; 2 in our region.

Key to the Species.

a. Seta arcuate when moist; leaves with a long, acute, subulate acumination. 1. *S. recurvata.*

a. Seta erect when moist; leaves with a rather short, linear, sub-obtuse subulation. 2. *S. calcarea.*

1. **Seligeria recurvata** (Hedwig) Bryologia Europæa. (*S. setacea* [Wulfen] Lindberg).

Densely gregarious, dark green, very small: stems short, about 1 mm. or less, simple or forking; leaves up to 1.5 mm. long, erect-spreading, flexuous, with a long, canaliculate, acute subulation from a lance-ovate base, the margins entire; costa long-excurrent, forming much of the subulation; basal leaf-cells thin-walled, pellucid, irregular or rectangular, above becoming quadrate and incrassate; perichætial tubulose-sheathing at base, towards apex lance-subulate; seta long, yellowish, arcuate when moist, but when old and dry often erect, more or less flexuous; capsule oval to subglobose, erect, thin-walled, short-necked, red-mouthed, turbinate when empty; exothecial cells lax; no annulus; operculum about as long as urn (each about 0.4 mm.), straight, subulate-rostrate; peristome-teeth 16, lanceolate to linear, obtuse to acute, sometimes irregularly bifid at apex, free, smooth, orange-pellucid, reflexed when dry.

On rocks in shade. Europe, Asia and, in North America, in Ontario, Pennsylvania, and in the Rocky Mountains. Occurs on limestone rocks in eastern Pennsylvania and may occur in similar habitats in central Pennsylvania.

2. **Seligeria calcarea** [Dickson] Bryologia Europæa.

Densely gregarious, dull, dark green: stems short, less than 1 mm., simple; leaves short, less than 1 mm., the lower lanceolate, the upper from an oblong concave base abruptly narrowed to a shorter, linear, obtuse or sub-obtuse, entire subulation; costa rather flat, indistinct below, above obscure and filling the whole apex; basal leaf-cells shortly rectangular, pellucid, thin-walled, above becoming irregularly quadrate to rounded or hexagonal, obscure, chlorophyllose, incrassate: seta straight, erect; capsule erect, oval-pyriform, turbinate when dry and empty, brownish; peristome-teeth 16, broadly lanceolate, rather densely articulate, flat, entire, smooth, orange-pellucid, reflexed when dry; lid subulate-rostrate but considerably shorter than the urn; spores mature in spring or early summer.

On calcareous or chalky rocks. Europe and, in North America, in Vermont, Ontario, Pennsylvania, and Lake Winnipeg. Rare. In our region reported but once.

Huntingdon: Warrior's Ridge. *Porter.* (Porter's Catalogue).

7. *DICRANELLA* Schimper.

Dioicous, rarely pseudautoicous: mainly small, gregarious, or cespitose, terrestrial: stem erect, thickly foliate, sparsely radiculose; leaves somewhat lustrous, from a sheathing base abruptly subulate and squarrose-spreading, or from a non-sheathing base gradually linear to subulate and stiffly erect to falcate-secund, mostly with plane edges; costa strong, mostly percurrent, often filling the acumen; leaf-cells elongate-rectangular to linear: seta erect; capsule cernuous, unsymmetric, short, short-necked, often strumate, or erect and symmetric; peristome-teeth usually present, mostly unequally subulately 2–3-cleft, papillose above, at the extreme base united to form more or less of a basal membrane, exteriorly finely vertically striate; operculum conic-rostrate or obliquely long-rostrate, sometimes as long or even longer than the urn.

A large and cosmopolitan genus of about 130 species; about 32 species in North America; at least 4 species in our region.

Key to the Species.

a.	Costa wide and flat and not well-defined at base; peristome weakly papillose; annulus often differentiated.	b.
a.	Costa narrow and sharply defined at base: peristome densely papillose; annulus not differentiated.	e.
	b. Seta red.	c.
	b. Seta yellowish.	d.
c.	Leaves squarrose from a sheathing base.	(*D. crispa* [Ehrhart] Schimper).
c.	Leaves not squarrose nor from a sheathing base.	(*D. curvata* [Hedwig] Schimper).
	d. Capsules erect and symmetric.	1. *D. fitzgeraldi.*
	d. Capsules more or less cernuous.	2. *D. heteromalla.*
e.	Leaves entire.	4. *D. varia.*
e.	Leaves serrulate or denticulate.	3. *D. rufescens.*

1. **Dicranella fitzgeraldi** Renauld and Cardot.

(*D. heteromalla* var. *fitzgeraldi* Grout).

(Plate VI)

Rather densely cespitose, yellowish-green: stem 5–10 mm. long, mostly simple, erect, leaves crowded, erect-spreading, sometimes subsecund, about 3–3.5 mm. long, up to 0.5 mm. broad at base, from the lance-ovate base narrowing above into a long, canaliculate-subulate, denticulate apex; costa at base rather indistinct, about one-fourth to one-third the width of the leaf, strong above and constituting most of the acumination; basal leaf-cells elongate-rectangular or sub-rectangular, reaching 8×55 microns, hyaline, a few in the extreme alar portion often quadrate, median cells quadrate: seta erect, yellowish-red, becoming quite dark brownish-red when old, about 7–8 mm. long, when dry sinistrorse in the lower half and dextrorse

above; capsule erect, symmetric, about .6–.9×.25–.3 mm., oblong, not constricted below mouth, smooth or nearly so even when dry and empty, when ripe brown; peristome single, the teeth very slightly united below, cleft about half-way into linear-subulate prongs, sometimes sub-cribrose along the divisural, articulate, longitudinally striolate-granulose, towards apex hyaline; spores minutely papillose, about .014–.017 mm., mature in late fall or winter; operculum low-conic with an oblique rostrum.

On soil, soil-covered rocks, etc., in the eastern and southeastern parts of the United States. Not rare in our region.

Allegheny: Schenley Park, Pittsburgh, August 16, 1905, McKees Rocks, August 27, 1905, and Fern Hollow, Pittsburgh, March 8, 1908. (Figured). O. E. J.; Wildwood Road, March 29, 1908. O. E. J. and G. K. J.

2. **Dicranella heteromalla** [Dillenius] Schimper.

(*Dicranum heteromallum* Hedwig).

(Plate VII)

Cespitose, bright yellowish to dark green; stem erect or ascending, 0.5–3.0 cm. tall: leaves numerous, lance-subulate, concave, 2–3 mm. long, denticulate towards the apex, usually also denticulate dorsally towards the apex; costa strong, one-fifth to one-third the width of the leaf at base, percurrent, bordered towards the apex by a narrow margin of lamina; leaf-cells parenchymatous, at leaf-base 2–5 times as long as wide, rectangular, brownish, narrower towards the margin, the upper cells shorter and often obliquely quadrilateral; seta 1.5–2.5 cm. long, greenish-yellow, dextrorse; capsule smooth, about 1.5 mm. long, oblong, castaneous to dark brown, more or less erect, usually slightly curved, when dry bent and curved in at the upper part just below the rim on one side in a very characteristic manner, furrowed; operculum hemispheric, with a linear obliquely inclined beak about 1 mm. long; peristome-teeth red, bifid to below the middle or about to the middle, sometimes trifid, with somewhat projecting trabeculæ, articulate, minutely papillose-striate, hyaline and papillose at apex; exothecial cells incrassate, irregularly elongate-rectangular to oblong-hexagonal, the end-walls thinner than the lateral walls, two to four rows of cells at the rim much smaller and rounded; spores .010–.014 mm., yellowish-incrassate, mature in autumn.

Common, especially in hilly or mountainous districts, on rocks, clay banks, soil-covered logs, etc. Europe, Asia, and, in North America, from lower Canada to the Gulf States. One of the most common mosses in our region.

Allegheny : More than fifty collections from various localities in the County have been examined.
Armstrong : Kittanning, August 16, 1906. O. E. J.
Beaver : Beaver Falls, May 14, 1907. O. E. J.
Center : Bald Eagle Ridge near Matternville, September 20, 1909, and mountain slope near Bear Meadows, September 21, 1909. O. E. J.
Crawford : Linesville, May 12, 1908. O. E. J.; Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
Fayette : Ohio Pyle, September 1-3, 1906. September 1-3, 1907, and Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.; Ohio Pyle, September 10, 1905. O. E. J. and G. E. K.; and May 30-31, 1908. O. E. J.
Lawrence : In gorge below Ellwood City, June 26, 1909. O. E. J.
Westmoreland : New Florence, Mellon's estate on Laurel Hill Mts., September 8-11, 1907. (Figured), Hillside, May 23, 1908, and May 22, 1909, "Shades" near Blackburn, March 25, 1910. O. E. J.; Laurelville, May 30-31, 1903. J. A. S.; Hillside, at top of Chestnut Ridge, September 16-17, 1909. O. E. J. and G. K. J.

3. **Dicranella rufescens** [Dickson] Schimper.

(Plate VII)

Rather loosely cespitose, reddish- to yellowish-green: stems erect, in our region generally very short, about 3 mm. high, mostly simple; leaves few, linear-lanceolate, reaching 1.5 mm. long, gradually narrowed, minutely denticulate towards apex, plane, erect-spreading or sometimes sub-secund; costa narrow, about one-seventh to one-sixth the width of the leaf-base, percurrent; basal leaf-cells large, hyaline, smooth, thin-walled, quadrate-rectangular to linear-rectangular, reaching 8–10 times as long as wide, median cells shorter and smaller but similar, the percurrent costa margined by cells similar to the median: seta erect, red, about 3–5 mm. long, dextrorse when dry; capsule globose-ovoid, erect, red, symmetrical, smooth to slightly wrinkled when dry, the urn wide-mouthed and more or less turbinate; operculum obliquely conic-rostrate, about as long as urn (0.5 mm.); calyptra cucullate, smooth, yellowish-red, narrowly conic, about 0.8 mm. long; spores globose, smooth, orange-pellucid, about .012–.015 mm., mature in late summer or fall.

Usually on damp, bare soil, in Europe, Asia, and, in North America, from Alaska to Nova Scotia and southwards to West Virginia. Rather common in our region.

Beaver : Clay bank of creek, New Galilee, September 10, 1906. O. E. J.
Cambria : Gallitzin. *James.* (Porter's Catalogue).
Elk : *McMinn.* (Porter's Catalogue).
Fayette : Clay roadside, Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
Huntingdon : *Porter.* (Porter's Catalogue).
McKean : Tuna Creek, Bradford, October 18, 1894, and March 31, 1895, and Niles Hollow, October 21, 1894. D. A. B.
Westmoreland : On elevated clay soil, Laurel Hill Mts., above New Florence, September 8-11, 1907. (Figured). O. E. J.; "Shades," near Blackburn, June 13, 1908. O. E. J.

4. **Dicranella varia** [Hedwig] Schimper.

(Plate VII)

Densely gregarious to cespitose, bright to yellowish-green; stems short, usually about 5–7 mm. high, ascending to erect, branching at base; leaves up to 2.5 mm. long, linear-lanceolate, gradually narrowed to a long-linear acumination, spreading to recurved, not very secund, when dry somewhat flexuous, margin narrowly revolute, entire, excepting sometimes at the very apex somewhat denticulate; costa wide and not well-defined, percurrent and comprising a large portion of the acumen; basal leaf-cells rather thin-walled, rectangular or with oblique end-walls, 2–6:1, gradually becoming smaller and narrower above, the upper being about 2–4:1 and somewhat incrassate, all smooth and more or less yellowish-pellucid: seta yellowish-brown to castaneous, ascending to erect, about 5–8 mm. long, sinistrorse; capsule ovate to oblong, more or less cernuous, reddish to pale castaneous, curved, smooth, together with lid about 1–1.25 mm. long; lid about as long as urn, rostellate; peristome-teeth large, lance-subulate, cleft to middle, strongly articulate, finely striate-papillose, rich castaneous below, sub-hyaline above; spores yellowish, rather thick-walled, minutely roughened, .020–.024 mm., mature in late autumn or in winter.

On bare clay soil in fields, on ledges, etc. Widely distributed in the Northern Hemisphere; in North America from Nova Scotia to Alaska and south to Georgia.

Allegheny : In niches on cliff, Powers Run, November 30, 1909. (Figured). O. E. J.
McKean : Bennett Brook, October 23, 1897. D. A. B.

8. *RHABDOWEISIA* Bryologia Europæa.

Autoicous: low, densely cespitose: stem without central strand, in cross-section obtusely pentagonal, densely foliate, radiculose, branched; leaves when dry crisped, decurrent, linear to linear-lanceolate, acute, plane-margined; costa strong, disappearing below the apex; upper leaf-cells chlorophyllose, quadrate to rounded, smooth; basal cells rectangular and hyaline: seta straw-yellow, erect; capsule erect, minute, symmetric, ovate to oblong, obtusely octagonal with darker striæ, 8-costate when dry; annulus none; peristome rarely absent, inserted on the rim; teeth arising from low, broad, more or less united bases, abruptly filiform or subulate, reddish-yellow, trabeculæ prominent ventrally but articulations scarcely projecting dorsally, surface of teeth non-papillose but often obliquely minutely striate; operculum long-subulate, obliquely rostrate, as long or longer than the urn; calyptra cucullate, rostrate, reaching to the middle of the capsule.

About 8 species of the Northern Hemisphere, inhabiting crevices of silicious rocks; 5 species in North America; 2 species in our region.

Key to the Species.

a. Leaves entire or nearly so. 1. *R. fugax.*
a. Leaves rather coarsely denticulate towards the apex. 2. *R. denticulata.*

1. **Rhabdoweisia fugax** (Hedwig) Bryologia Europæa.

(*Weisia fugax* Hedwig).

(Plate VII)

Densely cespitose, usually dark green: stems short, in ours about 5 mm. high, radiculose at base; leaves lance-linear, recurved-spreading, numerous, about 2–2.5 mm. long, usually somewhat concave, acute to shortly acuminate, margins plane, faintly denticulate towards apex, leaves crisped when dry; costa strong but not quite reaching apex; upper leaf-cells rounded-hexagonal, about .010–.014 mm., incrassate, chlorophyllose, papillose, rather yellow, arranged in rows, in the upper part of the leaf about 6 or 8 rows on either side of the costa, the apical cells larger and more hyaline, the basal cells pellucid and elongate-rectangular, about 2–8:1: seta erect, 2–3 mm. high, yellowish; capsule erect, symmetric, oval; the urn wide-mouthed, about 0.5–0.7 mm. high, brownish, when dry and empty 16-striate; operculum about as long as urn, obliquely rostrate from a broad base; peristome-teeth abruptly subulate from a broad base, small, not very persistent, articulate, papillose; spores about .018–.020 mm., minutely roughened, yellowish-pellucid, maturing in mid-summer; calyptra cucullate, covering about two-thirds of the urn; exo-

thecial cells yellowish, incrassate, irregularly oblong to rectangular, the upper 2 to 4 rows much smaller and rounded.

In crevices of various kinds of rocks, in moist, shady cliffs, etc., rarely in limestone. Mainly in the mountainous districts of Europe, Asia and America. In North America this species occurs in southern Canada and in northern United States, south to Missouri. Rare in our region.

McKean : Sandstone rocks between Hawkins and Rutherford Hollows, March 12, 1894, and Toad Hollow, July 19, 1896, and August 1, 1897. D. A. B.

In West Virginia this species occurs on the sandstone cliffs of Chestnut Ridge, 6 miles south of the West Virginia-Pennsylvania State boundary line. July 4, 1909. O. E. J. and G. K. J. (Figured).

2. **Rhabdoweisia denticulata** [Bridel] Bryologia Europæa.

Closely similar to *R. fugax* but leaves wider and more distinctly obtuse, more strongly denticulate; leaf-cells in 7 to 10 rows on each side of the costa in the upper part of the leaf: peristome-teeth more persistent.

We have seen no specimens of this species from our region, although it has been reported as follows:

Lawrence: Slippery Rock Creek. *James.* (Porter's Catalogue).

9. *ONCOPHORUS* Bridel.

Autoicous: rather large, cespitose in broad, soft, bright green or yellowish-green tufts, usually radiculose below: stems thickly foliate; leaves when dry crisped, when moist ascending to squarrose, from a sheathing base more or less abruptly long-acuminate or subulate, concave, carinate; costa strong, percurrent or excurrent; cells in the sheathing base of the leaf long-rectangular, translucent to hyaline, the alar differentiated, the laminal cells small, mostly rounded-quadrate, at the margin bi-stratose; perichætial leaves sheathing to above the middle, abruptly subulate: seta long, erect; capsule unsymmetric, strumose with a short collum, when empty more or less weakly sulcate; annulus indistinct; peristome-teeth 16, deeply inserted, approximate, united below into a tube which is adherent to the wall of the capsule, the teeth 2–(3)-divided to the middle, outwardly minutely papillose in longitudinal lines, the inner surface with 1 (or 2) delicate longitudinal lines and strongly projecting transverse plates; operculum at least half as long as the capsule, obliquely rostrate; calyptra cucullate.

A genus of 9 species widely distributed on damp gravelly soil, on moist non-calcareous rocks, or on decaying logs. Only one species in our range.

1. **Oncophorus wahlenbergii** Bridel.
(Plate VIII)

Densely cespitose, light or yellowish-green above, darker below: stem ascending or erect, forking, up to 3 cm. high, sparsely radiculose below; leaves numerous, dense, much crisped when dry, abruptly flexuous-spreading when moist, from a concave, widely obovate base abruptly contracting into a long, carinate, linear-subulate, flexuous, rather acute portion which is low-serrate at the apex both marginally and dorsally; costa strong, ending in the apex; leaf-cells at base mostly pellucid and obliquely elongate-rectangular, about 3–10:1, above at the shoulder and along the subulation quickly becoming much smaller, incrassate, about .005–.007 mm. in diameter, smooth, sometimes faintly rounded papillose: seta single, erect, flexuous, yellowish to brownish, when dry strongly dextrorse, 1–1.5 cm. long; capsule about 1.2 mm. long, arcuate-cernuous, oblong-cylindric, gibbous, distinctly sharply strumose, when old irregularly wrinkled; peristome-teeth united at base into a rather deeply inserted tube, the teeth divided to the middle, lance-linear, castaneous-pellucid, very faintly dorsally articulate below, strongly ventrally trabeculate in a double series separated by a more or less zigzag divisural line, at the base smooth, towards the middle minutely vertically striate-papillose, at the apex sub-hyaline; annulus narrow with crenulate margin; operculum obliquely rostrate; exothecial cells irregular, rather lax, with medium walls, not much different towards the mouth; spores papillose, castaneous-pellucid, about .028–.030 mm., mature in spring.

On rocks, soil, old logs, etc., in cool and moist situations, usually in the mountains in non-calcareous districts. Europe, Asia, and, in North America, from Greenland to Alaska and south to the northern United States. Rare in our region.

McKean : Broadbow, D. A. B.

10. *DICRANUM* Hedwig.

Autoicous or dioicous; mostly large and thickly tufted, often cushion-like: stems mostly erect; leaves mainly falcate-secund, more or less subulate-acuminate from a concave, lanceolate base, and usually canaliculate to tubulose; costa largely excurrent; alar leaf-cells mostly brownish and differentiated; inner perichætial leaves elongate, involute-sheathing, the acumen often short or lacking: seta erect, mostly twisted, sometimes 2 to 5 together in a perichætium; capsule various from cylindric and erect to cernuous and arcuate or even rarely strumose; operculum long-rostrate and by a differentiated annulus always with a notched edge; peristome not

inserted below the edge of the capsule; teeth mostly 2–3-parted to the middle, vertically striate below, ventrally trabeculate; calyptra not ciliate at base.

A cosmopolitan genus of about 150 species, mostly on non-calcareous sub-strata, in the tropics confined to the mountains and rather rare in the Southern Hemisphere. In North America about 65 species are known and at least 7 species occur in our region.

Key to the Species.

a. Capsule cernuous, unsymmetric. b.
a. Capsule erect, symmetric. g.
b. Leaf-cells porose. c.
b. Leaf-cells very slightly or not at all porose. (*D. subuletorum* R. and C.)
c. Leaves transversely undulate; costa not reaching apex. d.
c. Leaves not transversely undulate; costa percurrent to excurrent. f.
d. Upper leaf-cells elongated. 1. *D. polysetum.*
d. Upper leaf-cells iso-diametric. e.
e. Capsule solitary; costa and lamina dorsally smooth. (*D. bergeri* Bland.)
e. Capsules clustered: costa and lamina dorsally rough. (*D. drummondii* C. M.)
f. Capsules clustered: guides of costa in two rows. (*D. majus* Smith.)
f. Capsules solitary: guides of costa in one row. 2. *D. scoparium.*
g. Costa with median guides. h.
g. Costa without median guides, 2–4-stratose. 7. *D. longifolium.*
h. Entire lamina uni-stratose; costa percurrent. i.
h. Upper lamina more or less bi-stratose; costa excurrent. j.
i. Upper leaf-cells rectangular and mamillate dorsally. 3. *D. montanum.*
i. Upper leaf-cells less regular, not mamillate. 4. *D. flagellare.*
j. Costa and margin entire, apex usually broken off. 6. *D. viride.*
j. Costa and margin serrulate. 5. *D. fulvum.*

1. **Dicranum polysetum** Swartz, Schwaegrichen.

(*D. rugosum* Bridel; *D. undulatum* Ehrhart).

Tall, up to 20 cm. or more, loosely cespitose: stems erect or decumbent, densely radiculose below; leaves undulate, lustrous yellowish-green; 6–9 mm. long, lanceolate, the upper half spinosely serrate, the lower half with recurved margin; costa strong, rather narrow, vanishing in the apex, with two serrate dorsal lamellæ above; alar cells distinct, brownish, not reaching costa, median and upper leaf-cells elongate-elliptic to linear-fusiform, incrassate and porose: seta long, reddish,

usually 2–5 in a cluster; capsule arcuate-cernuous, rather small, when dry and empty striate and brown; spores mature in late summer or early fall.

On moist soil and on humus-covered rocks in moist and shady woods, usually in hilly or mountainous regions. Europe, Asia, and, in North America, in the northern United States and in Canada. Rare in our region.

Huntingdon: *Porter.* (Porter's Catalogue).

2. **Dicranum scoparium** [Linnæus] Hedwig.

(*Bryum scoparium* Linnæus).

(Plate VIII)

Large, rather loosely tufted, glossy, yellowish-green, often brownish below: stems growing upwards and dying away below, often 7 or 8 cm. long, densely felted-radiculose; leaves falcate-secund, often more or less tufted at the upper end of the innovations, about 8–12 mm. long, linear-subulate, not undulate, concave, serrate towards apex, little changed when dry; costa strong, flat, one-fourth to one-third the width of the leaf at base, above bearing four serrate dorsal lamellæ; leaf-cells at base enlarged, quadrate to rectangular, rather thin-walled, orange-colored, the median elongate rectangular to somewhat linear, incrassate, porose, the apical irregularly oblong, not porose: seta about 3 cm. long, erect-sinuose, yellowish to chestnut-brown, lighter below, usually sinistrorse, sometimes dextrorse above; capsule 3.5–4 mm. long, about 0.8 mm. thick, chestnut-brown, cylindric, arcuate, when dry furrowed and slightly constricted below the mouth, tapering below into a short neck, exannulate; operculum low-conic, subulate rostrate, the beak about 2.5 mm. long; calyptra about 6–7 mm. long, cucullate, conic-rostrate, peristome single; teeth pellucid, reddish-brown, papillose above, below strongly articulate and vertically striate, divided about one-half into 2 or 3 lance-subulate prongs, sometimes more or less cribrose; spores globose, slightly roughened, about .020–.024 mm., mature in late summer or nearly fall.

On soil, logs, rocks, etc., in woods. Europe, Asia, and, in North America, throughout the cooler and temperate regions. Quite common in our region.

Allegheny	: Near Sharon, on dry soil, February 10, 1887. J. A. S.
Cambria	: ***James.*** (Porter's Catalogue).
Center	: Stormestown, April 2, 1902. Miss H. E. Wilson; Tussey's Mt., near Shingletown, July 15 and September 15, 1909 O. E. J.
Clinton	: Near Lock Haven, July 15, 1908. O. E. J.
Erie	: Presque Isle, August 26, 1905. O. E. J.

Fayette : Ohio Pyle, September 1-3, 1906, and September 1-3, 1907. (Figured). O. E. J. and G. K. J.

Huntingdon : Tussey's Mt., near Baileyville, July 13, 1909. O. E. J.

McKean : Toad Hollow, Bradford, October 18, 1894, Rutherford Rocks, Bradford, June 19, 1896, and Langmade, November 3, 1895. D. A. B.

3. **Dicranum montanum** Hedwig.

(Plate VIII)

Densely cespitose, light yellowish-green, lustrous: stems erect, short, up to 1 cm. in our region, sparsely branching; leaves much crisped when dry, in the same cushion some of the plants with equally-spreading leaves, others with all secund leaves, from a wider base gradually narrowly linear-lanceolate, up to 5 mm. long, concave below and canaliculate above to near the apex, on margin and back of costa strongly serrulate above; costa rather strong, percurrent or almost excurrent, forming about one-fifth of the width of the leaf at base; median leaf-cells shortly rectangular-quadrate to laterally oblong, incrassate, yellowish, the upper somewhat smaller and rounded-quadrate, more or less distinctly papillose, the basal rectangular, thinner-walled, up to 6:1, the alar not much larger but quadrate-inflated, all the basal cells more or less castaneous in color; perichætial leaves similar to stem leaves; seta single, erect, yellowish to brownish, about 1.5 cm. high; capsule oblong-cylindric, slightly curved, yellowish to finally brownish, plicate when dry and empty, the urn about 2.5 mm. long; the lid conic, more or less obliquely rostrate, about 1.5 mm. long, castaneous; annulus narrow; peristome-teeth cleft to below the middle or nearly to the base into linear-subulate, deeply castaneous, articulate, faintly trabeculate, striate-papillose divisions; exothecial cells yellowish-incrassate, irregularly oblong to rectangular, the upper 3–6 rows much smaller, more deeply colored and incrassate, rounded-quadrate or hexagonal; spores smoothish, yellowish, about .022-.025 mm., not very thick-walled, maturing in early fall.

On rotten wood and on roots and trunks of trees. Europe, Asia, and, in North America, from Newfoundland to the northern United States and westward to the Rocky Mountains. Rather rare in our region.

Elk : *McMinn.* (Porter's Catalogue).

Huntingdon : *Porter.* (Porter's Catalogue).

Fayette : Ohio Pyle, on rotten log, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

4. **Dicranum flagellare** Hedwig.

(Plate VIII)

Rather densely cespitose, bright green above, brownish below, tufts about 1 cm. high: stems radiculose, often with flagellæ in the axils of the upper leaves, erect; leaves crisped and sub-secund when dry, falcate-secund when moist, from an oblong base narrowed gradually into a subulate acumen, strongly involute to near the apex, apex serrate; costa strong, about one-fourth to one-third the width of the leaf-base, percurrent, serrate dorsally at the apex; alar leaf-cells large, distinct, inflated-quadrate, rather thin-walled, colored, reaching nearly to the costa, the leaf-cells above loosely elongate-rectangular, farther above becoming shorter, above the middle rounded-quadrate, incrassate; perichætial leaves shorter, abruptly subulate-acuminate from a sheathing base: seta erect, sinistrorse when dry; reddish to yellow-brown, about 2 cm. long; capsule erect, cylindric, symmetric, reddish-brown, about 2.5 mm. long, when dry striate and often slightly curved; lid obliquely long-rostrate, lustrous, brown; peristome-teeth trabeculate, articulate, confluent at base, cleft to two-thirds to three-fourths, the lower two-thirds reddish and more or less vertically striate-papillose, hyaline above; annulus delicate; exothecial cells elongate, strongly laterally incrassate with thinner end-walls, several series at the rim much smaller and rounded-quadrate; calyptra reaching to the middle of the capsule, fugacious; spores globose, slightly roughened, yellow-incrassate, .018–.022 mm. in diameter, mature in summer.

On decayed logs and stumps and on bases of trees in moist woods. In Europe, Asia, and, in North America, from Nova Scotia to British Columbia and south to Mexico. Rather common in our region.

Blair	: *Porter.* (Porter's Catalogue).
Cambria	: Flinton, July 23, 1908. O. E. J.
Erie	: Presque Isle, August 26, 1905. O. E. J.
Fayette	: Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.; also September 10, 1905. O. E. J. and G. E. K.
Huntingdon	: *Porter.* (Porter's Catalogue).
McKean	: West Branch, February 27, 1896. D. A. B.
Somerset	: Allegheny Mts., August 17, 1875. John D. Shafer.
Westmoreland	: Mellon's estate, New Florence, September 8-10, 1907. O. E. J. (Figured).

5. **Dicranum fulvum** Hooker.
(*D. interruptum* Bryologia Europæa.
(Plate IX)

Deeply but rather loosely cespitose, fulvous to brownish-green: stem ascending to erect, sparsely branching, radiculose at base; leaves numerous, secund, somewhat crisped when dry, about 5–6 mm. long, gradually narrowed, from a concave lanceolate base to a linear-acuminate more or less concave to canaliculate apex, the upper margin serrulate; costa strong, about one-third of leaf-width at base, usually somewhat excurrent, dorsally serrulate above, in the long acumination occupying most of the leaf; median and upper leaf-cells quadrate to shortly rectangular, strongly yellowish-incrassate, the lower rectangular, not porose at base, becoming in the alar portion enlarged, inflated, rectangular to quadrate, thin-walled, brownish, this alar area reaching usually to the costa; perichætial leaves linear-subulate from a broadly sheathing base: seta single, rather stout, erect, flexuous, yellowish to dark with age, about 1–1.5 cm. long; capsule erect, symmetric to slightly curved, the urn about 4 mm. long, cylindric, castaneous, sulcate when dry and empty; lid stoutly and more or less obliquely rostrate and about 1.5 mm. long; annulus rather narrow; exothecial cells yellowish-incrassate, quadrate to rectangular or oblong-hexagonal, several rows below the mouth much smaller and rounded-quadrate-hexagonal; spores large, .024–.030 mm., smoothish, rather thin-walled, mature in autumn.

Generally on non-calcareous rocks in moist woods among the hills or mountains. Europe and North America from Nova Scotia and North Carolina west to the Mississippi River. Rather uncommon in our region.

Fayette: On rocks in woods, Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

McKean: Toad Hollow, June 9, 1896, Bolivar, August 6, 1897, Quintuple, April 11, 1898, and Rutherford, September 16, 1898, all near Bradford. D. A. B.

6. **Dicranum viride** (Sullivant) Lindberg.
(Plate IX)

Densely cespitose, yellowish-green to dark green or sometimes almost blackish: stems ascending, up to 2 cm. high, simple or sparsely branching, radiculose below; leaves 3–4 mm. long, spreading or recurved, when dry crisped, the apices usually found broken off, the leaves close, gradually linear-acuminate from a lanceolate base, concave below, the acumination often concave or canaliculate, the margin entire or slightly denticulate at apex; costa strong, percurrent or excurrent, at base comprising from one-fourth to one-third the

width of the leaf: median and upper leaf-cells more or less regularly quadrate, small, incrassate, towards base slightly larger, but not much longer than broad, non-porose, suddenly becoming enlarged, thin-walled, brownish, and rectangular up to 3:1, the alar inflated and sometimes extending to the costa: capsule oblong, erect or slightly curved. Not seen in fruit in our region.

On decayed logs and on bases of trees in woods, rarely on rocks, in Europe, Asia, and, in North America, from Newfoundland to the Rocky Mountains, south to Pennsylvania and Ohio.

Butler : On base of *Tilia*, Brush Creek swamp, Crider's Corners, April 26, 1908. O. E. J. (Figured).
Cambria : Wiltmore. *James.* (Porter's Catalogue).
McKean : Rutherford, October 17, 1895. D. A. B.
Westmoreland: On sandstone boulder at edge of stream, "Shades," near Blackburn, March 25, 1910. O. E. J.

7. **Dicranum longifolium** [Ehrhart] Hedwig.

(Plate IX)

Densely cespitose, pale green, glossy: stems more or less deeply castaneous, ascending, geniculate at intervals, at least 3–5 cm. long, sparingly brownish-tomentose below; leaves lustrous, pale green, yellowish-green and hardly altered when dry, falcate-secund, about 5–8 mm. long, linear-subulate, from a short lanceolate base about one-fourth the length of the leaf, at the base reddish or brownish, non-decurrent; costa wide, comprising about one-third the width of the leaf-base, somewhat narrowed at insertion, the upper three-fourths of the leaf consisting entirely of the linear-subulate, canaliculate, more or less spinose-denticulate, excurrent costa; alar leaf-cells lax, rather thin-walled and hyaline, sometimes brownish, rounded and extending to the costa, the laminal cells immediately above with medium walls, obliquely oblong-angular, narrower towards the margin and further above becoming smaller and rhomboid-quadrate along the margin to elongate-rectangular near the costa: capsule cylindric, erect, nearly straight, smooth, produced but rarely.

On tree-trunks and on non-calcareous rocks in hilly or mountainous regions, in Europe, Asia, and, in North America, from Greenland and British Columbia south to Colorado and North Carolina. Rare in our region.

McKean : Bradford, 1896. Sterile. D. A. B. (Figured).

11. *DICRANODONTIUM* Bryologia Europæa.

Dioicous: tall mosses mostly in dense tufts, the stems and often the basal portion of the costa on the under side felted-

radiculose: leaves weakly or not at all auriculate, from the lanceolate base long-subulate, canaliculate-tubulose, the acumen often plainly toothed on the margin and dorsal surface of the costa by reason of the mammillate cells; costa broad and flat, long, excurrent, and almost filling the acumen; alar cells reaching the costa, inflated, hyaline, sometimes reddish, delicate, areolation above the alar cells widened towards the costa and rectangular to long-hexagonal, at the margin usually united into a more or less broad border; perichætial leaves sheathing, abruptly long-subulate: seta arcuate, finally erect-flexuous; capsule symmetric, oblong-cylindric, smooth; annulus not differentiated; peristome inserted below the edge of the capsule-mouth; teeth separate, two-parted deeply, or to the base, the divisions filiform-subulate, below vertically and above obliquely striate-papillose; calyptra cucullate.

A cosmopolitan genus of 21 species; 4 species in North America; 3 species occurring in our region.

Key to the Species.

a. Peristome-teeth cleft to base: leaves with somewhat widened auricles. 1. *D. longirostre.*

a. Peristome-teeth not cleft to base: leaves non-auriculate. b.

b. Leaves easily caducous: seta 1.5–2 cm., urn 1.5-2 mm. long. 2. *D. virginicum.*

b. Leaves rather peristent: seta 5–8 mm., urn 1 mm. long. 3. *D. millspaughii.*

1. **Dicranodontium longirostre** [Starke] Bryologia Europæa. (*Didymodon longirostris* Starke).

(Plate IX.)

Densely and softly cespitose, lustrous, pale green, when dried as in herbarium-specimens often a lustrous yellowish-brown: stems erect or ascending, up to 3 or 4 cm. high, forking frequently, flexuous, radiculose below; leaves rather numerous, often quickly deciduous, from a more or less sheathing oblong concave base with more or less widened auricles gradually narrowed to a long, flexuous-spreading or falcate-secund, linear-subulate or setaceous, tubulose point, the margin entire to faintly denticulate towards the apex; costa strong, one-fifth to one-third the width of the leaf at base, excurrent in the rough subulation, in cross-section showing a median row of large hyaline cells bordered on either side by minute incrassate cells; alar leaf-cells large, inflated, hyaline to brownish, rectangular, above becoming incrassate and narrower, in the oblong base the upper marginal cells elongate-linear and more or less prosenchymatous, the median and upper rounded-quadrate, varying to short-rectangular or oblong: seta cygneous, dextrorse; capsule oblong-cylindric, small; peristome-

teeth cleft to the base or nearly so into two filiform divisions, inserted below the mouth of the urn, reddish; lid as long as the urn, subulate-rostrate, straight; spores mature in late fall or in winter: dioicous.

On sandstone rocks, walls, turfy places, etc., usually in hilly or mountainous regions. Europe, Asia, and, in North America, from New Brunswick and Alaska south to Ohio and Pennsylvania. Rare and usually sterile in our region.

McKean: Rutherford Rocks, July 7, 1894, Hawkins, October 18, 1895, Langmade Rocks, April 16, 1896, all in the vicinity of Bradford. D. A. B. (Figured).

2. **Dicranodontium virginicum** E. G. Britton.

Lustrous, bright green: stems ascending to erect, below red-tomentose; leaves erect-spreading to secund, variously straight to curled or twisted, often 5 mm. long, narrowly concave-subulate from a short, thick, non-auriculate base, often caducous, the caducous leaves usually with smooth points, the persistent ones with serrulate points; alar cells more or less hyaline, the median and upper rectangular to quadrate, incrassate; seta appearing lateral by growth of innovations, flexuous, up to 2 cm. long, lustrous, yellow, arcuate to erect; capsule cylindric, 1.5 to 2 mm. long; peristome-teeth deep red, not deeply inserted, split about to the middle, papillose-striate at base, sub-hyaline above; no annulus; lid subulate-rostrate, shorter than the urn, straight or curved; calyptra cucullate, rostrate, covering only the upper third of urn; spores small, mature in summer: dioicous, antheridia terminal.

At the southern border of our region, on sandstone boulder along wooded path, Tibbs Run, Monongalia County, West Virginia. C. F. Millspaugh.

3. **Dicranodontium millspaughii** E. G. Britton.

(*Campylopus flexuosus* Sullivant)

Silky, cespitose, yellowish-green; stems rufous-tomentose at base, up to 3 cm. long; leaves erect-spreading to secund, up to 5 mm. long, from a broad, concave, non-auriculate base narrowly tubulose-subulate; costa strong, excurrent into a linear tip, dentate marginally and dorsally; alar leaf-cells large, hyaline, mainly quadrate to shortly rectangular, extending to the costa, above quickly smaller, incrassate, tending to fusiform-prosenchymatous towards the margin, shorter to quadrate in the upper part of the lamina: seta cygneous, erect when old, 5–8 mm. long, stout; capsule pyriform-cylindric, smooth, the urn about 1 mm. long; peristome-teeth deeply inserted, red, confluent at base, split to the middle or perforate to the base, papillose-striolate below, paler above; no annulus but the rim

of the urn dark colored; lid about as long as the urn (1 mm.), straight, subulate-rostrate; spores maturing in summer: dioicous.

At the southern border of our region on sandstone rock in deep woods along Tibbs Run, Monongalia County, West Virginia. C. F. Millspaugh.

Family III. *LEUCOBRYACEAE.*

Dioicous, rarely autoicous; densely cespitose and more or less spongy like *Sphagnum,* whitish to glaucous-green: stem without central strand, scarcely radiculose; leaves pluriseriate, close, quite uniform in size; costa very broad, constituting most of the leaf, sometimes narrow with a stereid-bundle, composed of two kinds of cells, the outer large and parenchymatous with perforated inner walls, the inner smaller and chlorophyllose, the lamina hyaline, usually very narrow and mainly basal: seta single, erect; capsule erect and symmetric or inclined, unsymmetric and strumose; annulus none; peristome usually inserted below the edge of the urn, the teeth mostly 16, sometimes only 8, lanceolate, articulate, entire or cleft to the middle; operculum conic, rostrate; calyptra cucullate or sometimes mitrate.

With the exception of the genus *Leucobryum* the species of this family are mostly tropical or sub-tropical in their distribution and occur mainly on trees. In our region there occurs only the following genus:

1. *LEUCOBRYUM* Hampe.

Dioicous: thickly to loosely cespitose; whitish or glaucous green, mostly lustrous: leaves erect, when dry appressed and brittle, sometimes spiral, or falcate, or squarrose-spreading, from an ovate base lanceolate- to subulate-acuminate, canaliculate or sometimes almost tubulose above; costa flat, the large parenchymatous outer cells 2–6-layered; lamina mostly narrow, often vanishing below the apex, without a border; perichætial leaves half-sheathing and long-acuminate: seta terminal, or lateral by the growth of innovations, long; capsule more or less arcuate, unsymmetric, often strumose, with 8 rib-like projecting ridges; peristome on the edge of the urn, the teeth united at base into a tube, cleft to the middle into two lance-subulate prongs, thickly trabeculate, vertically striate and papillose; operculum subulate from a conical base; calyptra inflated, cucullate, covering the urn.

About 106 species, mostly in the tropics, on trees, rocks, or on shaded earth; 16 occurring in North America; 2 species in our range.

Key to the Species.

a. Leucocysts on the median line in 3 to 4 layers; leaves 3 to 9 mm. long: capsules arcuate, strumose. 1. *L. glaucum.*
a. Leucocysts on the median line in 2 layers in 4 to 14 series; leaves 1 to 4 mm. long: capsule almost erect, not strumose. 2. *L. albidum.*

1. **Leucobryum glaucum** [Linnæus] W. P. Schimper.

(*Dicranum glaucum* Hedwig).

(Plate X)

In dense, rounded, spongy, whitish or glaucous tufts, often 6 or 7 cm. deep, only the upper 5 mm. or thereabouts alive, the dead inner portion grayish-brown and peaty: leaves crowded, in our region about 3–6 mm. long, more or less tubular, acute, entire, ovate-lanceolate, narrowed at base, erect-appressed, consisting almost wholly of the broad, thick costa, the lamina extending about half-way up the leaf as a narrow margin of 2–5 rows of hyaline, thin-walled, long-rectangular to linear cells: seta about 10 mm. long, sinistrorse, castaneous, erect; capsule 1.5 to 2 mm. long, castaneous, when dry arcuate, oblong-cylindric, distinctly strumose, furrowed; lid long-rostrate, nearly as long as the urn; calyptra longer than the capsule; peristome slightly inserted, deep reddish-brown, dicranoid; spores rather thin-walled, slightly roughened, .015–.020 mm. in diameter, slightly roughened, mature in autumn. Capsules are produced infrequently.

Almost cosmopolitan on soil or on rocks in woods. In North America it occurs from Newfoundland to Florida and westward to the Rocky Mountains. Common in our region, especially preferring the somewhat acid soil of exposed white oak-woods, often thus associated with *Kalmia* and some of the wild huckleberries.

Allegheny : Darlington Hollow, June 26, 1885. J. A. S.; Coraopolis, September 4, 1905, O. E. J. and G. E. K.; Douthett, December 29, 1908, and under hemlocks, Darlington Hollow, October 25, 1908. O. E. J.; Stewart's Stop, Charleroi Electric R. R., August 19, 1907. O. E. J. and G. K. J.

Armstrong : Kittanning, August 16, 1906. O. E. J.

Center : Scotia, in Barrens, July 14 and September 23 (Figured), and Tussey's Mt., near Shingletown, July 15, 1909. O. E. J.

Crawford : Pymatuning Swamp, on elevated hummock, Linesville, June 12, 1905, and May 12, 1908. O. E. J.

Erie : Presque Isle, June 9-11, 1905. O. E. J.

Fayette : Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
Greene : Deer Lick, September 22, 1904. O. E. J.
McKean : Marilla Brook, Bradford, April 1, and September 26, 1896. D. A. B.
Washington : Valley of Maple Creek, Charleroi, April 24, 1908, and Hanlin, May 21, 1908. O. E. J.
Westmoreland : "Shades," near Blackburn, March 25, 1910. O. E. J. and G. K. J.

2. **Leucobryum albidum** [Bridel] Lindberg.

(*L. minus* Hampe; *Dicranum albidum* Bridel).

Much smaller than *L. glaucum;* tufts very dense, about 1–2 cm. deep; leaves acute, narrower, shorter (about 1–4 mm. long), closely imbricated and but little spreading at the tip: capsule almost symmetric, little or not at all inclined, slightly or not at all strumose.

On stumps, logs, or on the ground, Europe and in the eastern part of the United States. Rare in our region.

Huntingdon : *Porter.* (Porter's Catalogue).
Westmoreland: A sterile specimen from near Bear Cave, Chestnut Ridge, Hillside. September 17, 1909. O. E. J. and G. K. J.

Family IV. *FISSIDENTACEAE.*

Autoicous or dioicous: minute to large, gregarious to cespitose, mostly green: stem oval, mostly with central strand, basally radiculose, or with reddish rhizoids from the leaf-axils; leaves distichous, mostly vertically placed, so that they stand edgewise to the stem with a clasping sheath at the base, or extending well up the leaf, and a dorsal lamina which is often somewhat decurrent, the apical lamina being lacking in the perichætial and lowest stem leaves and little developed in *Bryoxiphium;* costa usually present; leaf-cells small, uniform, rounded-hexagonal, chlorophyllose: seta erect or cygneous, usually elongated; capsule erect and symmetric, or cernuous and unsymmetric or curved, smooth, collum present; annulus present or none; peristome present, except in *Bryoxiphium,* usually inserted, simple, red; teeth articulate, united at base, cleft to the middle or below into two or three filiform divisions, trabeculate with two series of projecting transverse plates, yellowish; spores mostly small; operculum more or less rostrate; calyptra small, narrowly conical, entire or cleft on one side, rarely several times cleft, mostly smooth.

A family of over 600 species, largely tropical, with widely varied habitats, representated in our range by three genera.

Key to Genera.

a. Dorsal lamina very narrow: peristome none: stem radiculose-bulbiform at base. 1. *Bryoxiphium.*
a. Dorsal lamina usually broad: peristome present: stem not radiculose-bulbiform at base. b.
b. Mostly not aquatic, sometimes submerged but floating. 2. *Fissidens.*
b. Aquatic, filiform, floating mosses. 3. *Octodiceras.*

1. *BRYOXIPHIUM.* Mitten.

(*Eustichia* Bridel).

Slender, dioicous, more or less densely silky-cespitose, bright green or yellowish: stem stiff, oval in cross-section, with central strand, radiculose at the extreme base, upwardly flattened, with distichous, closely imbricated leaves, simple or irregularly branched; leaves from a linear-lanceolate base, either linear, with a small acumen, or rounded and abruptly more or less long-subulate, denticulate above; costa percurrent, with a very narrow dorsal wing which does not extend to the base of the leaf; basal leaf-cells hyaline, rectangular, upper cells chlorophyllose, triangular to irregularly trapezoidal, smooth, towards the margin linear and forming a distinct border; perichætium terminal, with two concave, ovate, prolonged-acuminate, serrulate leaves with a complete dorsal wing: seta shorter than the perichætial leaves, flexuous or cygneous; capsule spherical, oval or obovate, smooth; no peristome or annulus; spores .015–.020 mm. operculum abruptly and irregularly rostrate; calyptra smooth, covering about one-third of the urn; antheridial plants similar in appearance to the archegonial.

Three species; one in Mexico, one in Asia, and one in Europe and the United States, rare.

1. **Bryoxiphium norvegicum** [Bridel] Mitten.

(*Eustichia norvegica* Mueller).

Plants 1–2.5 cm. long, somewhat flexuous, flat, lustrous, yellow, fastened to vertical sandstone cliffs by a radiculose bulbiform base; stems mostly simple; leaves short-acuminate and as described for the genus; costa vanishing at or near the apex: seta rather thick, about 2 mm. long; capsule obovate, pale yellow, mouth reddish, peristome none; operculum reddish at base, attached to columella and long-persistent; calyptra cucullate, large, tipped with a slender beak.

On shaded vertical exposures of sandstone in Wisconsin, Kentucky and Central Ohio, also in Iceland, and once in Pennsylvania.

Lawrence : "Slippery Rock Creek, Lesquereux." (Porter's Catalogue). The writer has not been

able to find this species along Slippery Rock Creek, where Lesquereux found it.

2. *FISSIDENS* Hedwig.

Autoicous or dioicous: stem short to long, erect to procumbent, more or less branched or simple; leaves prominently winged, linear-obovate to lanceolate-obovate; costa usually present; cells rounded-hexagonal, sometimes loosely rhomboidal, rarely prosenchymatous, smooth or papillose: seta erect or ascending, long to short, mostly terminal, sometimes lateral; capsule mostly exserted, erect or inclined, symmetric or unsymmetric; peristome mostly inserted below the mouth of the urn, teeth cleft, exteriorly articulate, often striate-papillose; spores mostly small; operculum conic to rostrate; calyptra entire to once or rarely several times cleft, mostly smooth.

A widely distributed genus of about 550 species, mainly tropical, on soil, rocks, trees, humus, or in water. In our region at least 8 species.

Key to the Species.

a. Costa none: minute plants 2–4 mm. high. 1. *F. hyalinus.*
a. Costa well developed. b.
b. Leaves bordered, at least on the vaginant lamina, by a band of linear cells. c.
b. Leaves not bordered, or at least the border not composed of linear cells. g.
c. Costa percurrent, confluent with border at apex and forming a mucro: capsule erect. 2. *F. bryoides.*
c. Costa not usually percurrent; border not usually reaching apex: capsule curved or erect. d.
d. Leaves non-bordered, entire, obtuse. 3. *F. obtusifolius.*
d. Leaves bordered, at least on sheath, acute or apiculate. e.
e. Leaves bordered to near the apex. f.
e. Leaves usually bordered only on the sheath. 5. *F. exiguus.*
f. Leaves broadly oblong-lanceolate: capsules usually more or less curved: plants usually more than 2 mm. 4. *F. incurvus.*
f. Leaves narrowly oblong-lanceolate: capsules usually erect: plants often less than 2 mm. high. 4a. *F. inc. minutulus.*
g. Leaves without a marginal band of several rows of somewhat paler cells, the outer row sometimes paler. i.
g. Leaves with a marginal band of several rows of paler incrassate cells. h.
h. Leaf-cells rather obscure, about .006–.010×.006–.014 mm. 6. *F. cristatus.*
h. Leaf-cells distinct, about .012–.016×.015–.025 mm. 7. *F. adiantoides.*
i. Costa excurrent into the apiculus. 8. *F. taxifolius.*
i. Costa not quite reaching apex. j.
j. Leaves apiculate: seta terminal: leaf-cells .010–.016×.014–.020 mm. 9. *F. osmundioides.*

j. Leaves more or less rounded at apex: seta lateral in basal half of stem: leaf-cells about .008—.011 mm.
10. *F. subbasilaris.*

1. **Fissidens hyalinus** Hooker and Wilson.

Gregarious, pale green, minute, 2–4 mm. high: stem usually simple, erect; leaves in 3–5 pairs, soft, the upper much larger, lance-oblong, acute, non-costate, margined by a single row of narrow elongate cells, the sheath hardly reaching the middle of the leaf, margin entire; cells large, about .030–.045× .060–.100 mm., thin-walled, elongate-hexagonal, hyaline: seta terminal, 1–2 mm. long, erect smooth; capsule oblong, erect, thin-walled; teeth closely articulate, red, cleft to the middle; operculum rostrate; calyptra cylindric-conic and covering the rostrum only of the operculum; spores .014–.020 mm.

The original station of this rare moss was "Moist, rocky ledges, Bank Lick, on Cassidy's farm, near Cincinnati, Ohio," where it was first collected by T. G. Lea, in 1839. This station has since been lost, but the moss has been found elsewhere in Ohio: on ground in deep ravines near Painesville.—H. C. Beardslee, and later in Pennsylvania, as follows:

Washington: On clay banks with *Fissidens taxifolius* in ravines near Washington, September and October, 1892, 1894, and 1898. *Linn* and *Simonton.*

2. **Fissidens bryoides** [Linnæus] Hedwig.
(*Hypnum bryoides* Linnæus).
(Plate X)

In loose tufts or densely gregarious, rather dark green: stems ascending or erect, 5–15 mm. high; leaves numerous, ascending, or the apical erect, oblong-lingulate, usually abruptly and somewhat obliquely acuminate, the sheath reaching about half way to the apex, the dorsal lamina gradually becoming very narrow at base, the border strong and reaching the apex, where it becomes confluent with the costa, margin entire or sometimes faintly denticulate at apex; costa strong; leaf-cells rounded-hexagonal, somewhat incrassate, somewhat smaller at the apex of the sheath, becoming rectangular at the base, the border consisting of two or three rows of linear-prosenchymatous incrassate cells: seta erect, flexuous, about 4–9 mm. long, yellowish to reddish, smooth, slender, terminal: capsule erect or arcuate, usually reddish-yellow, smooth, oblong-oval, about 7–8 mm. long; peristome-teeth red, the upper two-thirds split into two awl-like prongs with spiral thickenings, pellucid, papillose, the teeth inserted below the mouth; spores smooth, small, about .010–.012 mm. in diameter; operculum conic-rostrate. Mature in late fall. Antheridial flowers gemmiform, axillary.

Widely distributed in temperate regions on shaded soil, in our region especially in and about greenhouses. Our specimens show considerable variation in the arrangement of the leaf-cells, either in rows or not so, and in the capsule, the latter varying from erect and symmetric to arcuate. The spores in our specimens are much smaller than is indicated in some descriptions.

Allegheny : In flower-pots, Phipps Conservatory, Schenley Park, Pittsburgh, March 20, 1910. O. E. J. (Figured).

Elk : *James.* (Porter's Catalogue).

3. **Fissidens obtusifolius** Wilson.

(Plate X)

Small, densely gregarious, sometimes forming cushions, usually growing at right angles to the substratum, pale green: stems comparatively stout, in our specimens about 3–6 mm. long, mostly simple; leaves of fertile plants about 4–8 pairs, of sterile shoots about 6–12 pairs, distichous, vertical, in fertile shoots closely placed, the lower small, obovate to oblong, the upper much larger, oblong, ascending to erect, obtuse, the clasping portion extending above the middle, non-margined except for a few elongate cells at the end of the sheathing portion, entire, the apical leaves reaching to 1.5 mm. long by 0.3 mm. wide; cells rounded to quadrate-hexagonal above, a few at the margin of the base rectangular (up to 4:1), at the apex of the sheath a few marginal cells elongate to linear, all incrassate; costa strong, disappearing shortly below the apex, the dorsal lamina becoming narrow or disappearing at the base: seta comparatively stout, erect, or upcurving, in ours about 1.5–2.0 mm. long, brownish, smooth; the capsule erect, oblong-oval to oblong-obovate, somewhat narrowed below the mouth, smooth, brownish; operculum hemispheric-apiculate to very shortly rostrate; peristome yellowish-pellucid, trabeculate, the teeth lanceolate, acuminate; capsule walls with cells incrassate, quadrate to hexagonal; spores smooth, .018–.023 mm. Mature in autumn.

On wet rocks from New England to Minnesota, Colorado, Texas, and Alabama. Rare in our region.

Beaver : Gorge of Little Beaver Creek, on sides of large sandstone rocks in dashing current and often inundated, Smith's Ferry, October 1, 1910. O. E. J. (On the Ohio-Pennsylvania State Line.)

In West Virginia on walls of Lock No. 9, Monongahela River, a short distance south of the West Virginia-Pennsylvania State Line, July 3, 1909. O. E. J.

4. **Fissidens incurvus** Starke, Schwaegrichen.

Typically this species is about 2–6 mm. high, with rather broadly oblong-lanceolate leaves, which are obtuse-apiculate and narrowly bordered up to near the apex: seta reddish, long, flexuous; capsule oval-cylindric, curved and usually more or less inclined or cernuous; antheridial buds basal.

On rocks, or more rarely clay, usually in shaded brooks and ravines, America from Greenland to Vancouver Island to Texas. Europe, Asia, Africa, New Zealand.

Fayette : On muddy rock in bed of mountain rivulet, Ohio Pyle, June 14, 1908. O. E. J. and G. K. J.

McKean : Hunt's Run, April 28, 1893. D. A. B.

In our region this species is rare in its typical form but is represented by a form closely approaching, but perhaps not quite typical,—variety *minutulus* (Sullivant) Austin, as follows:

4*a*. **Fissidens incurvus** variety **minutulus** (Sullivant) Austin.

(*F. minutulus* Sullivant).

(Plate X)

Plants minute, 0.8–5.0 mm. high, gregarious, green, erect: stem simple, reddish; leaves 3–7 pairs, hardly imbricate, the uppermost much larger and incurved-erect and up to 2.5 mm. long, narrowly oblong-lanceolate, more or less acute, the border narrow, ceasing below apex, widest at upper part of sheath, margin entire or somewhat undulate, the sheath about one-half the length of the leaf, the inferior lamina narrowing at base but hardly decurrent; costa strong, ending usually a little below apex; leaf-cells incrassate, more or less rounded to hexagonal, rather irregular, the basal becoming rectangular, the border consisting of 1–3 rows of elongate-linear or ascending prosenchymatous cells: seta reddish, smooth, erect, subflexuous, about 3–6 mm. long; capsule usually erect, symmetric, 0.7–0.9 mm. long, yellowish to dark chestnut color, oval-oblong, tapering abruptly at base; peristome rich red-chestnut, the teeth deeply forked into two awl-like prongs with prominent spiral thickenings, teeth slightly inserted; spores round to oblong, pellucid, pale yellow-red, smoothish, .014–.017 mm. in diameter; operculum conic-rostrate. Mature in early autumn.

On damp stones and rocks, in shady woods or in stream beds, Nova Scotia to Vancouver Island and south to Texas; Europe.

Allegheny : Schenley Park, Pittsburgh, August 20, 1905, Darlington Hollow, November 9, 1908, Keown, November 14, 1909, and Powers Run, November 30, 1909. O. E. J.

Lawrence : Gorge below Ellwood City, June 26, 1909. O. E. J.; October 15, 1910. O. E. J. and G. K. J.
McKean : Hawkins Hollow, Bradford, August 2, 1895. D. A. B.
Westmoreland : Rachelwood, New Florence, September 8-11, 1907. O. E. J. (Figured.)

5. **Fissidens exiguus** Sullivant.

(Plate XI)

Plants very small, gregarious, light green: stems, in our specimens, 1–2.5 mm. high, erect, or ascending; leaves usually 3–5 pairs, the lower minute, the upper reaching 1.5 mm. long, ascending to erect, oblong-lanceolate, acute, only the sheath margined, entire, the dorsal lamina narrowing to none at the base, the sheath about one-half the length of the leaf; costa stout, vanishing a little below apex; cells in apical lamina quadrate to hexagonal, at base of leaf becoming rectangular, the sheath being bordered, especially in its upper part, by a border one to four cells wide, of elongate and more or less prosenchymatous cells, all cells moderately incrassate or more so in border of sheath: capsule on an erect, somewhat flexuous, stout, reddish pedicel 2–5 mm. long; capsule oblong-oval, narrowed to pedicel at base, somewhat constricted below mouth, smooth, reddish-yellow, about 0.5–0.7 mm. long; operculum conic-rostrate, about two-thirds the length of the capsule; calyptra narrow, dimidiate; teeth red, split to the middle into two awl-like prongs which have spiral thickenings, closely infolded in wet specimens, inserted a little below edge of mouth; spores smooth, about .020 mm. in diameter. Mature in September.

Rather common on stones and rocks in stream beds, especially in ravines. Southern Canada, United States east of the Rockies, England.

Allegheny : On sandstone rocks, ravine of Powers Run, November 30, 1909. O. E. J.
Fayette : Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J. (Figured.)

6. **Fissidens cristatus** Wilson.

(*F. decipiens* De Notaris).

(Plate XI)

Usually tufted, branching from the base, green to dark green; stem erect, 1–2 cm. high; leaves numerous, ascending, imbricate, the upper reaching 2.5 mm. long, oblong-lingulate, acute, crenulate below, irregularly serrate above, inferior lamina narrowed and somewhat decurrent at base, sheath ex-

tending half-way to apex or a little above; costa strong, ending just below or in the apex; leaf-cells irregularly angular to rounded-hexagonal, about .008–.012 mm. in diameter, some of these next to the costa larger, the marginal 3 or 4 rows paler and forming a rather obscure belt around the leaf, all cells incrassate: seta ascending, usually about 1 cm. high, smooth, light chestnut color, arising from the lower half of the stem; capsule oblong, smooth, about 2 mm. long, tapering to the seta, ascending to nearly erect, chestnut-brown, constricted below the mouth at least when old; peristome bright red-chestnut, the teeth split at one-third above the base into two very slender, trabeculate, somewhat spirally papillose prongs; operculum conic, rostrate; spores about .020 mm. in diameter, smooth, pale yellowish, globose. Mature in winter or early spring.

On moist soil and stones or occasionally at base of trees, Nova Scotia to the Gulf States and the Rocky Mountains, Europe, Asia.

Allegheny : Montrose, September 1, 1905, and Wildwood Road, November 19, 1908. O. E. J.

Crawford : On bark at base of black ash, Linesville, June 11-12, 1907. O. E. J. (Figured.)

Fayette : Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.; Ohio Pyle, July 4, 1908. O. E. J.

McKean : Bennett Brook, Bradford, May 3, 1893. D. A. B.

7. **Fissidens adiantoides** [Linnæus] Hedwig.

This species differs chiefly from *F. cristatus* in that the cells are larger, .012–.016×.015–.025 mm., distinct: seta usually longer than in *F. cristatus*, about 1–2.5 cm. long. The plants are often much larger, 2–15 cm. high, and are monoicous instead of dioicous, as in *F. cristatus*.

This species is reported as common in the eastern United States but all the specimens we have seen from our region labeled as *F. adiantoides* we have referred to *F. cristatus*.

8. **Fissidens taxifolius** [Linnæus] Hedwig.

(*Hypnum taxifolium* Linnæus)

(Plate XI)

Plants gregarious, light green, branching at base, usually 5–10 mm. high, erect to ascending: stem rather stout and rigid; leaves close, imbricate, oblong-ovate, apiculate, uniformly crenulate, non-bordered, ascending, the middle leaves usually longest and up to 2 mm. long, the inferior lamina ending abruptly at the base, sheath extending to the middle or beyond; costa strong and excurrent in the apiculus; leaf-cells rounded-

hexagonal, about .010 mm. in diameter, incrassate, one or two rows next the costa larger, the marginal row usually a little paler, the costa at the apex widening and consisting of elongate parenchymatous cells: seta about 8–14 mm. long, flexuous-ascending, smooth, yellowish-castaneous, arising near the base of the plant; capsule varying from sub-pendulous to erect, oblong, slightly inflated on the back, smooth, about 1.5 mm. long, tapering abruptly to the seta, castaneous to dark brown; peristome bright red-chestnut, the teeth inserted a little below the mouth of the capsule, forked to below the middle, the prongs very slender, trabeculate, somewhat spirally papillose; spores smooth, about .016–.017 mm. in diameter, pale yellowish-pellucid; operculum conic, obliquely rostrate to about half the length of the capsule. Mature in late fall or winter.

On damp clayey soil, eastern United States, Europe, Asia, Africa.

Allegheny : Powers Run, April 17, 1908. O. E. J.
Fayette : Ohio Pyle, September 1-3, 1906, and Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.; Ohio Pyle, June 14, 1908. O. E. J.
McKean : Bennett, October 26, 1898, (Figured.) and Quintuple, March 30, 1898. D. A. B.
Lawrence : Gorge of Conoquenessing above Rock Point, October 15, 1910. O. E. J. and G. K. J.

9. **Fissidens osmundioides** [Swartz] Hedwig.
(*Dicranum osmundioides* Swartz).

Densely tufted, 1–5(–10) cm. high, dark green, tomentose below with brown rhizoids: stems simple or sometimes branched basally, erect; leaves numerous, close but hardly imbricated, the apical ones the largest, oblong-lanceolate, serrulate towards the apex, non-bordered, usually rounded and apiculate at apex, the sheath reaching from one-half to two-thirds the leaf-length, inferior lamina often ceasing abruptly at base and not decurrent; costa ending just below the apex; leaf-cells oval- or rounded-hexagonal, large, about .010–.018× 012 –.025 mm., incrassate, a single row at margin often paler, pellucid, and a little smaller: seta terminal, yellowish to chestnut-red, about 5–10 mm. long; capsule narrow-oblong, suberect to inclined, thick-walled, chestnut-brown or darker; operculum conic with a needle-like usually straight beak nearly as long as the urn; calyptra cucullate or several-lobed at base; spores smooth, about .018–.025 mm. Mature in midsummer.

In swampy woods and along streams, quite widely distributed in the cooler portions of the Northern Hemisphere, reaching the northern United States. It occurs in Eastern

Pennsylvania and in Ohio but has not yet been found in Western Pennsylvania.

10. **Fissidens subbasilaris** Hedwig.

(Plate XII)

Cespitose in wide mats, 5–10 mm. high, erect or ascending, green, brownish tomentulose at base: stems branching at base; leaves usually in 10–18 pairs, crisped when dry, widely spreading to ascending, close, imbricate, those in middle of stem often largest, the largest reaching about 1.5 mm., the sheath reaching about three-fifths the length of the leaf, leaf oblong, rather obtuse, but apiculate with a pointed cell, nonbordered, minutely crenulate below, irregularly serrate above, the inferior lamina ceasing abruptly at the base; leaf-cells incrassate, and rather obscure, small, about .007–.012 mm., roundish-hexagonal; the costa ending considerably below the apex: seta smooth, arising from basal part of stem, ascending, usually about 3–5 mm. long and reaching about to the top of stem, light chestnut-color; capsule cylindric-oval, about 1.5 mm. long, smooth, chestnut-color to dark brown, tapering at base, erect or very nearly so; calyptra narrowly cucullate; operculum conic, obliquely rostrate to about one-half the length of capsule; peristome rich chestnut-color, strongly trabeculate, not papillose, the teeth slightly inserted, bifid to about the middle into two slender prongs; spores smooth, pale yellowish pellucid, round, about .016–.018 mm. in diameter. Mature in late autumn.

On earth and on rocks and bases of trees, Ontario and southwards through our Eastern States.

Allegheny : On base of white oak, Douthett, December 29, 1908 (Figured), and Keown, November 14, 1909. O. E. J.

Fayette : Base of rotten stump, Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.

McKean : Quintuple, at base of old tree, April 18, 1900. D. A. B.

Indiana and Westmoreland: James. (Porter's Catalogue.)

3. *OCTODICERAS* Bridel.

(*Conomitrium* Montagne).

Plants slender, fasciculately branching, floating, filiform: leaves remote, lance-linear, short-auriculate: flowers monoicous, the male axillary, the female on elongated branchlets; seta short; capsule thin-walled, erect, very small, without stomata; calyptra minute, conic, undivided, covering only the rostrum of the operculum; operculum conic-rostrate; peristome-teeth variously laciniate or entire and evidently degenerate; annulus none; spores about .018–.025 mm.

This genus includes about 25 species of aquatic mosses more or less resembling *Fontinalis* in general appearance, widely distributed over the earth,—2 species occurring in eastern United States, and likely to be found in our region.

Key to the Species.

a. Large much-branched plants, up to 15 cm. long: seta shorter than the capsule. 1. *O. debilis.*

a. Small little-branched plants, up to 4 cm. long: seta longer than the capsule. 2. *O. hallianus.*

1. **Octodiceras debilis** (Schwaegrichen) New Combination.

(*Octodiceras julianus* Bridel; *Conomitrium julianum* Montagne; *Fontinalis juliana* Savi).

Plants up to 15 cm. long, flaccid, floating, blackish-green below, much branched: leaves distant, spreading, numerous, linear-lanceolate, entire, non-bordered, vaginant lamina one-fourth the length of the leaf, inferior lamina not reaching base, costa ending considerably below the apex; leaf-cells irregular hexagonal or more quadrate below, about .015–.020×.020–.030 mm., thin-walled: seta shorter than capsule, pale, fragile at base, elliptic, erect, scarcely raised above perichætial bracts, symmetric; operculum conic-rostrate and about as long as urn; peristome-teeth short, imperfect, 16, yellowish-pellucid, irregularly cleft and perforate in upper part; calyptra conic, dark, erose at base; spores about .020–.022 mm., mature in summer.

Almost cosmopolitan, but rather local, on stones and on wood in creeks and springy swamps. It has not been collected in Western Pennsylvania other than as follows:

Huntingdon : Porter. (Porter's Catalogue.)

2. **Octodiceras hallianus** (Sullivant and Lesquereux) Jaeger and Sauerbeck.

(*Conomitrium hallianum* Sullivant and Lesquereux; *Fissidens hallianus* Mitten).

Plants smaller, up to 3–4 cm. long, laxly tufted, dirty-green: stems sparsely fasciculate-branching at base; leaves remote, narrowly linear-lanceolate, usually in 5–10 pairs, entire, the sheath not reaching over one-fourth or one-third the length of the upper pair of leaves, inferior lamina narrowing and reaching almost to the base; cells irregularly hexagonal, tending to quadrate below, about .015–.022 mm.: seta longer than capsule, pale; capsule pale, elliptic-oblong; peristome-teeth undivided, reddish, subulate-lanceolate, articulate, inserted below the mouth of urn, papillose; operculum acutely conic-rostrate and about as long as urn; calyptra cucullate, covering the entire operculum; spores smooth, about .018–.024 mm.

On wood and stones, in streams, swamps, etc., New Jersey, New York, Illinois, Florida, Idaho, etc. Not reported for our

immediate region, but likely overlooked on account of small size.

Family V. *TORTULACEAE.*

Autoicous or dioicous, rarely par-, syn-, or polyoicous: mostly small or medium-sized, more or less densely cespitose, rarely gregarious: stems mostly with central strand, radiculose below, thickly foliate, simple or more or less branched; leaves pluri-seriate, rarely 3-seriate, lanceolate to broadly ovate or obovate; costa heterogeneous, mostly percurrent, or excurrent, sometimes with longitudinal lamellæ or with green branched filaments on the ventral surface above the middle; leaf-cells parenchymatous, the basal rectangular to elongate, mostly pellucid, or hyaline, upper cells always chlorophyllose, on both sides mostly warty papillose, loose, sometimes towards the apex 4–6-angled, or small and rounded-quadrate; seta more or less elongate, mostly straight, rarely almost lacking; capsule erect, symmetric, rarely slightly inclined, straight to slightly arcuate, mostly oblong to cylindric, rarely oval to spherical; collum short, rarely none; peristome various to none, mostly inserted on the mouth of the urn, usually without projecting trabeculæ; teeth 16, straight or spirally twisted, often united at base into a tube, entire or 2–3-cleft into filiform-subulate divisions, papillose; operculum mostly conic, rostrate; calyptra mostly cucullate, smooth, rarely papillose or minutely bristly or short-hirsute.

A very large family, mainly confined to the temperate zones, occurring almost entirely on soil or on rocks. The systematic relationships and the scope of the family are variously treated by different bryologists who have taken different characters as the basis for the various classifications.

Key to Genera.

a. Leaves mostly narrow, often linear-lanceolate, never broadest above the middle; costa with several guides, no accompanying cells, but 2 stereid bands, rarely long-excurrent. b.

a. Leaves mostly broad, ovate-oblong to spatulate or lingulate; costa with 2 median guides, with accompanying cells, and 1 stereid band, mostly more or less long-excurrent. l.

b. Plants minute; areolation dense, strongly papillose above; capsules cleistocarpous. 1. *Astomum.*

b. With deciduous operculum. c.

c. Peristome none. d.

c. Peristome present, rudimentary or well-developed. e.

d. Operculum deciduous with the columella detached. 4. *Hymenostylium.*

d. Columella remaining in the urn after the falling away of the operculum. 3. *Gymnostomum.*

e. The exterior surface of the teeth more strongly developed and with projecting plates. 2. *Weisia.*

e. Both surfaces of the teeth equally well-developed and no projecting plates. f.
f. Perichætial leaves long-convolute-sheathing. 8. *Barbula.*
f. Perichætial leaves not or but little convolute-sheathing. g.
g. Leaves more or less lingulate, margins plane; cells smooth. 7. *Didymodon.*
g. Leaves more or less lanceolate. i.
i. Leaf-margins plane or involute; cells papillose. j.
i. Leaf-margins more or less revolute; leaf-cells nearly smooth or papillose. k.
j. Divisions of peristome erect or slightly dextrorsely twisted. 5. *Trichostomum.*
j. Divisions of peristome distinctly sinistrorsely twisted. 6. *Tortella.*
k. Peristome-teeth 16, more or less 2-cleft or perforate, erect or dextrorsely ascending. 7. *Didymodon.*
k. Peristome-teeth 32, filiform, strongly twisted sinistrorsely. 8. *Barbula.*
l. Cleistocarpous; capsule spherical to oval, apiculate. 9. *Phascum.*
l. Operculate. m.
m. Peristome-teeth 16. n.
m. Peristome-teeth 32, filiform, sinistrorsely twisted, with a high basal membrnae. 12. *Tortula.*
n. Peristome-teeth none, or rudimentary from a low basal membrane. 10. *Pottia.*
n. Peristome-teeth small, separate to the base, more or less divided into two slender prongs. 11. *Desmatodon*

1. *ASTOMUM* Hampe.

Autoicous, rarely polyoicous: small, gregarious to cespitose, dull green: stem with a few-celled central strand, radiculose, thickly foliate; upper leaves tufted, when dry mostly crisped, keeled, from a broad base lanceolate to subulate-lanceolate, margin plane to involute, entire; costa strong, percurrent or excurrent; leaf-cells in upper part of leaf small, rounded-quadrate, papillose both sides, the lower cells elongate-quadrangular, thin-walled and hyaline: capsule mostly immersed, almost spherical to oblong-elliptic, mostly with a small, elongate-conic operculum, which, however, is rarely deciduous; calyptra cucullate, rarely mitrate, smooth.

A widely distributed genus of 21 terrestrial species; 5 species occurring in North America; 3 species in our region.

Key to the Species.

a. Leaves crisped when dry. b.
a. Leaves not crisped when dry; capsule castaneous, ovoid. 3. *A. nitidulum.*
b. Capsule brown, globose; spores usually .014–.017 (rarely .020) mm. in diameter, mature in spring. 1. *A. crispum.*
b. Capsule brownish to orange, sub-globose; spores usually .021–.027 mm., ripe from late autumn to early spring. 2. *A. sullivantii.*

1. **Astomum crispum** [Hedwig] Hampe.

(*Systegium crispum* Schimper; *Weisia crispa* Mitten).

Densely gregarious to sub-cespitose, pale to dark green: stem 5–12 mm. high, usually branched above, erect; leaves numerous, close, when dry crispate, the stem-leaves small, lance-linear, the comal and perichætial much larger, elongate-linear from a narrowly oblong, concave, whitish base, usually narrowly involute above, the apex acute; costa strong, acutely and shortly excurrent-mucronate, sometimes upturned so as to make the leaf somewhat cucullate; basal leaf-cells laxly long-rectangular, hyaline, upper leaf-cells sub-quadrate, densely chlorophyllose, papillose: seta erect, shorter than the capsule; capsule immersed, globose, small, brownish; lid distinct but not separating from the urn of its own accord, minute, conic-apiculate; exothecial cells laxly hexagonal to oblong-hexagonal, one to three rows of cells being somewhat smaller at the junction of the lid; calyptra cucullate; spores papillose, .014–.018 mm., mature in spring: autoicous.

In old sandy or clayey fields, principally in non-calcareous districts, temperate Europe, Japan, Algeria, and, in North America, from Saskatchewan to Pennsylvania, Kansas, and Texas. Not yet reported from our region but to be expected.

2. **Astomum sullivantii** Bryologia Europæa.

(*Systegium sullivantii* Jaeger).

Densely cespitose, green: stems simple or sparsely branched above, erect; leaves close, when dry spirally twisted and crispate; capsule brownish to bright orange-colored, subglobose, immersed; spores .021–.027 mm., mature from autumn to early spring.

On the ground in old fields and in moist grassy spots, "especially in new clover fields," in temperate North America.

Beaver : *James.* (Porter's Catalogue).

Indiana : *James.* (Porter's Catalogue).

3. **Astomum nitidulum** Bryologia Europæa.

(*Systegium nitidulum* Jaeger).

Smaller than *A. sullivantii*, the stem-leaves narrowly linear-lanceolate; the perichætial leaves broadly lance-ovate, long-acuminate, over twice the length of the stem-leaves: seta longer, about two-thirds as long as the capsule; capsule ovoid, castaneous, lustrous; lid obliquely rostellate; calyptra smaller than in *A. sullivantii*. (As has been suggested by Grout, this appears to be merely a variety of *A. sullivantii*.)

On the ground in old fields and grassy places, in Pennsylvania and Ohio. Rare.

Indiana : Derry, *James.* (Porter's Catalogue).

2. *WEISIA* Hedwig.

Autoicous, rarely paroicous, polyoicous, or dioicous: low, cespitose, freely branching: upper leaves much larger, relatively to the lower, erect-spreading, crisped when dry, carinate, elongate-lanceolate; costa strong, cuspidate-excurrent; basal leaf-cells rectangular, hyaline, the upper small, rounded, low-papillose on both surfaces: seta erect or sometimes curved, mostly longer than the perichætial leaves; capsule erect and symmetric or a little inclined and swollen dorsally, round-ovate to cylindrical, narrow-mouthed, finally usually somewhat plicate, the urn at the rim being several cells thick and the insertion of the peristome thus considerably removed from the exterior border of the rim; peristome-teeth short, often rudimentary, undivided, papillose, the exterior layer more strongly developed and with projecting bars; lid obliquely long-rostrate; calyptra cucullate.

A widely distributed genus of 27 terrestrial species; 6 species occurring in North America; only one in our range.

1. **Weisia viridula** [Linnæus] Hedwig.

(*Bryum viridulum* Linnæus).

(Plate XII)

Densely cespitose, yellowish-green: stem erect, often branching, up to 5 mm. tall; leaves erect-spreading, the upper much larger and up to 3 mm. long and 0.5 mm. wide, lance-linear, tapering to an acute or acuminate apex, the margin strongly involute, entire, leaves crispate when dry; costa strong, about .030–.040 mm. wide at base, excurrent into a short and more or less hyaline point; upper leaf-cells roundish-hexagonal, strongly papillose, obscure, the basal more or less elongate-rectangular and hyaline: seta slender, up to 1 cm. long, lustrous, yellowish, faintly sinistrorse; capsule erect, ovoid, symmetric, slightly narrowed at mouth, reddish-brown, about 0.9 mm. long, somewhat plicate when dry and empty; exothecial cells rather thin-walled, irregularly oblong to hexagonal or rounded, those at the mouth in 3–5 rows, much smaller, quadrate and darker in color; peristome-teeth more or less rudimentary, short, irregularly linear, divided, or truncate, papillose; lid conic, obliquely long-rostrate, altogether nearly as long as the urn; calyptra cucullate, covering about two-thirds of the capsule; spores orange-pellucid, papillose, about .016–.019 mm. in diameter, mature in spring.

Almost cosmopolitan on bare earth in fields, excavations, along roadsides, etc. Rather uncommon in our region.

Fayette : Ohio Pyle, on clay bank, September 1—3, 1906. O. E. J. and G. K. J. (Figured.)

McKean : Bradford, November 21, 1896, Divide, Bolivar and Bennett, December 15, 1896, and Quintuple, March 20, 1898. D. A. B.

Washington: *Linn* and *Simonton*. (Porter's Catalogue).

3. *GYMNOSTOMUM* Hedwig.

Dioicous: densely cespitose, rusty in color below: stem thickly foliate, sparsely radiculose, in cross-section circular, the central strand few-celled, the branching dichotomous; leaves erect-spreading, more or less carinate, not crisped when dry, rarely appressed or curved; elongate-lanceolate or subulate, margin plane; costa strong, vanishing below the apex; upper leaf-cells rounded-quadrate, small, thickly papillose on both sides, as is also the costa, lower cells rectangular, the walls yellow; perichætial leaves somewhat sheathing at the base; seta long, erect; capsule erect, symmetric, oval or oblong, when ripe smooth and shining, the wall of the capsule not distinctly thickened at the mouth; peristome none; operculum conic, rostrate, easily deciduous; calyptra narrowly cucullate, covering about half of the urn.

A widely distributed genus of 11 species, mainly occurring on calcareous rocks; 3 species occurring in North America; only one in our region.

1. **Gymnostomum calcareum** Nees and Hornschuch.

(Plate XII)

Densely cespitose, yellowish-green: stems erect, branched, up to 10 mm. high or more; leaves about 1 mm. long, spreading, somewhat recurved, elongate-oblong-lanceolate, somewhat concave, usually larger and tufted at the apex of the stem, obtuse, plane-margined; upper leaf-cells densely papillose, small, incrassate, obscure, the interior basal cells hyaline, rectangular or up to 2–3:1; costa strong, ending below the apex: seta erect; capsule oblong, often somewhat constricted below the mouth when dry and empty, erect, symmetric, tapering below; lid conic, obliquely rostrate, the beak one-half to two-thirds as long as the urn; calyptra cucullate; peristome none; exothecial cells rectangular to quadrate, at the mouth becoming smaller, darker and quadrate in 3 to 5 rows; spores smooth, .008–.011 mm. in diameter, mature in summer.

Cosmopolitan on damp limestone rocks and boulders, but rare in our region.

Lawrence : Gorge near Rock Point, June 26, 1909. (Figured.) Sterile. O. E. J.

4. *HYMENOSTYLIUM* Bridel.

Dioicous: densely and deeply cespitose, green to rusty or yellowish-green: stem densely foliate, sparsely radiculose,

without a central strand, triangular in cross-section; leaves erect-spreading, rarely squarrose-recurved, when dry involute, sometimes somewhat twisted when dry, not crisped, more or less carinate, elongate-lanceolate, acuminate; costa mostly ending below the apex; laminal leaf-cells thick-walled, smooth or papillose: seta long, erect; capsule erect, symmetric, obovate, firm, when empty smooth and pyriform; peristome none; lid obliquely long-rostrate from a broad base, remaining attached to the columella and deciduous thus attached; calyptra cucullate, covering about half of the urn.

A widely distributed genus of about 21 species, occurring mainly on calcareous rocks; 8 species in North America; only one occurring in our region.

1. **Hymenostylium curvirostre** [Ehrhart] Lindberg. (*Gymnostomum curvirostre* Hedwig; *Weisia curvirostris* Mueller).

(Plate XII)

Closely cespitose, 2–4 cm. high, bright green above, darker and more or less ferruginous below: leaves little or not at all twisted when dry, erect to recurved-spreading when moist, narrowly lanceolate-acuminate, 1–1.5 mm. long, apex acute, base sub-clasping, margin entire but papillose, as are also the entire upper and lower surfaces of the lamina and costa; costa strong, vanishing just below the apex, at base occupying about one-eighth the entire width of the leaf; upper leaf-cells rounded to sub-quadrangular, the lower towards the costa becoming elongate-rectangular: seta 8–10 mm. long, lustrous, castaneous; capsule about 1 mm. long, rounded ovate, lustrous, castaneous, widest towards the mouth, when dry and empty decidedly urceolate; peristome none; operculum with a long and oblique rostrum at least two-thirds the length of the urn, the operculum often remaining attached to the columella for some time after the spores have been shed; spores yellowish, moderately incrassate, smooth, about .014–.017 mm. in diameter, mature in September or October.

Not uncommon on wet cliffs, principally calcareous, in Europe, Asia, northern Africa, and, in North America, from Alaska to Labrador south to California and the Carolinas.

Allegheny : Guyasuta Hollow, Aspinwall, on wet cliff near waterfalls, October 12 and 25, (Figured) 1908, and September 8, 1909. O. E. J.

Lawrence : On wet face of exposure of the Homewood Sandstone, near Rock Point, October 15, 1910. O. E. J. and G. K. J.

5. *TRICHOSTOMUM* Hedwig.

Dioicous, rarely autoicous: densely cespitose, medium size, green to yellowish-green: stem with central strand, erect, radiculose, rarely felted, densely leaved, mostly dichotomously branching; leaves spreading, mostly crisped when dry, upper leaves much the larger, long and narrow, more or less concave to canaliculate, margins mostly erect to involute, often undulate, mostly entire; costa well-developed, sometimes ending below the apex or excurrent; upper leaf-cells small, rounded, chlorophyllose, papillose on both faces, towards the base elongated-rectangular, mostly hyaline: seta long, erect; capsule erect, rarely inclined, mostly symmetric, oblong-cylindric to cylindric, short-necked, rarely strumose; basal membrane of peristome low or none, the teeth erect, smooth or papillose, red or yellow, undivided or cleft into two filiform non-articulated divisions which are sometimes approximate in pairs; spore small; lid conic, rostrate, the exothecial cells of the base in vertical series or rarely dextrorsely ascending; calyptra cucullate, smooth.

A genus of about 100 species, widely distributed on earth and rocks. About 20 species in North America; only one in our region.

1. **Trichostomum cylindricum** (Bruch) C. Mueller. (*Didymodon cylindricus* Bryologia Europæa: *T. tenuirostre* Lindberg).

(Plate XII)

Rather loosely and softly cespitose, yellowish, dark below: stems erect branching, rather flexuous, reaching to 1.5–2 cm. in height; leaves about 2–3 mm. long, narrowly linear-lanceolate, when dry crisped and contorted, when moist spreading or flexuous, gradually acuminate or sometimes rather abruptly narrowed to an acute apex, the margin papillose-sinuate, plane or involute; basal leaf-cells elongate-rectangular or more or less angular-oblong, somewhat inflated, hyaline in a broad band that does not extend up the margin, above rather abruptly becoming much smaller, incrassate, quadrate to rounded-hexagonal, the median and upper rounded-quadrate to rounded-hexagonal or transversely oblong, densely papillose, much incrassate; costa strong, usually forming the apex of larger pellucid cells: seta single or sometimes in pairs, slender, erect, about 1.5 mm. long, yellow; capsule linear-cylindric, brownish; lid conic and obliquely rostrate; peristome-teeth short, untwisted, linear-subulate, fragile, usually more or less irregularly cleft or perforate; spores mature in autumn: dioicous: fruit produced but rarely.

On wet non-calcareous stones in brooks or at the base of cliffs in hilly or mountainous districts, in Europe, Asia,

South America, and, in North America, from Greenland to Manitoba and southward in the mountains to North Carolina. Rare in our region.

Huntingdon: Alexandria. *Porter.* (Porter's Catalogue).
McKean : Toad Hollow, Bradford, July 19, 1896. Sterile. D. A. B. (Figured).

6. *TORTELLA* (C. Mueller) Limpricht.

Dioicous; rarely autoicous: widely and deeply cespitose, the cushions often yellowish-green outside, brownish inside: stem erect, mostly without a central strand, felted-radiculose: leaves tufted at the apex of the stem, widely spreading to recurved-squarrose from a whitish and shining base, cirrhate-crispate when dry, elongate-lanceolate to subulate, margin undulate, entire, usually involute above; costa strong, ending in the apex or excurrent; basal leaf-cells differentiated, hyaline, elongate-rectangular, extending up the margins, smooth; upper cells green, small, rounded-quadrangular, thickly papillose on both sides: seta red, long, erect; capsule erect to inclined, oblong to cylindric; annulus rarely differentiated; peristome attached below the rim of the urn, the basal membrane low, teeth 32, filiform, sinistrorsely wound, papillose; spores small; lid small and elongate-conic; calyptra cucullate, smooth, long-rostrate.

A cosmopolitan genus, the 33 species mainly occurring on soil or on rocks; 5 species in North America; 2 in our region.

Key to the Species.

a. Dioicous: leaves long-acuminate. 1. *T. tortuosa.*
a. Autoicous: leaves linear-lanceolate to oblong-lanceolate, costa shortly excurrent as an abrupt mucro. 2. *T. humilis.*

1. **Tortella tortuosa** [Linnæus] Limpricht.

(*Barbula tortuosa* Weber and Mohr; *Tortula tortuosa* Ehrhart).

Densely cespitose in rounded tufts, yellowish or pale green above, brownish below: stems stout, branching, up to 6 cm. high, red-brown-radiculose; leaves crowded, usually 4–6 mm. long, lance-linear, tapering to a gradually acuminate apex, flexuous-spreading, margin crenulate-papillose, more or less undulate, plane at the apex; leaves when dry strongly crispate-contorted; costa strong, pale, excurrent into the fine and sometimes denticulate acumen; basal leaf-cells thin-walled, hyaline, extending obliquely up the margin, above becoming abruptly smaller, chlorophyllose, rounded, incrassate, papillose: seta 1–3 cm. long, reddish below, paler above; capsule cylindric, 2.5–3.5 mm. long, usually somewhat curved, almost erect; lid obliquely and slenderly conic-rostrate, at least one-half as long as urn; peristome-teeth long and from a low basal mem-

brane, two or three times dextrorsely twisted; spores mature in late spring or early summer.

On rocks, usually calcareous, in hilly or mountainous districts, Europe, Asia, northern Africa, and, in North America, from Greenland to West Virginia and from Idaho to Vancouver Island. Rare in our region.

Cambria: Cresson. *James.* (Porter's Catalogue).

2. **Tortella humilis** (Hedwig) New Combination.

(*Tortula caespitosa* Hooker and Greville; *Barbula caespitosa* Schwaegrichen).

(Plate XIII)

Loosely cespitose, green to yellowish-green, about 5 mm. high; leaves crispate when dry, erect-spreading when moist, oblong-lanceolate and about 2 mm. long below, the upper linear-lanceolate and up to 3.5 mm. long, somewhat concave, the margin plane or sometimes involute, the perichætial leaves similar and sheathing; costa strong, excurrent-cuspidate; the lower one-fourth of the leaf has a large V-shaped patch of hyaline rectangular cells reaching about .018×.085 mm., the median cells rounded-hexagonal, papillose, rather opaque, much smaller, about .007–.008 mm. in diameter, the upper similar: seta yellowish-brown, 15–20 mm. long, erect, dextrorse; capsule yellowish-brown, ovoid-cylindric, about 2–2.5 mm. long, 0.5 mm. thick, erect, symmetric, sometimes arcuate, tapering at the base; peristome single, of 32 filiform, papillose, articulate teeth about 0.6–0.8 mm. long, two or three times dextrorse, arising from a low membrane scarcely exserted above the mouth of the capsule; spores globose, somewhat papillose, about .008–.011 mm., mature in early summer; operculum narrowly conic-rostrate; calyptra smooth, cucullate, rostrate, covering about one-half of the capsule.

Almost cosmopolitan in temperate or sub-tropical regions on earth and on the roots of trees in the woods. Rather common in our region.

Allegheny : Coraopolis, September 11, 1905, and near Carnot, October 11, 1908. O. E. J. (Figured).
Cambria : *James.* (Porter's Catalogue).
Fayette : Ohio Pyle, September 1—3, 1906. O. E. J. and G. K. J.
Huntingdon: On limestone rocks, Pennsylvania Furnace, July 13, 1909. O. E. J.
McKean : Bolivar Run, September 6, 1897. D. A. B.

7. *DIDYMODON* Hedwig.

Dioicous, rarely synoicous: paraphyses filiform: mostly slender plants, red or brown, cespitose: stem with central

strand, thickly foliate, radiculose, the branches reaching to about the same height; leaves more or less keeled, erect-spreading, mostly lanceolate from a broad base, the margin revolute; costa well developed, upwards cylindrical, rarely excurrent; leaf-cells small, rounded-quadrangular, often smooth, sometimes the basal elongate and pellucid: seta long, erect; capsule erect, oblong to cylindric, sometimes slightly arcuate, short-necked, smooth; no annulus; peristome inserted on the edge of the urn, papillose, the trabeculæ projecting; teeth 16, plane, narrow, undivided, or perforate, or cleft to the base into filiform parts approximate in pairs; spores small; operculum conic-rostrate; calyptra cucullate, smooth.

A widely distributed genus of 80 species, on soil or rock, mainly in temperate regions; 17 species in North America; only one in our region.

1. **Didymodon recurvirostre** [Dickson] New Combination.
(*D. rubellus* Bryologia Europæa; *Barbula rubella* Mitten; *Weisia recurvirostra* Hedwig).

Cespitose in large, soft patches, bright green above, rusty-red below; stems erect, branched, usually 2–5 cm. high, radiculose below; leaves when dry flexuous and somewhat curled, when moist somewhat recurved-spreading from the appressed and whitish base, narrowly lance-linear, the comal longer, abruptly acute, margin narrowly revolute to near apex, apex obscurely denticulate; costa either ending in the apex or minutely apiculate-excurrent; basal leaf-cells elongate, rectangular, pellucid, medium-walled, the median and upper much smaller, papillose, rather obscure, quadrate; perichætial bracts long-sheathing: seta long, red, slender, sinistrorse; capsule erect, oblong-cylindric, becoming reddish-brown, smooth; annulus fragile, revoluble; peristome-teeth 16, united at base into a very low membrance, linear from a wider base, nodose-articulate, reddish, minutely roughened, with the median line but rarely divided; lid short, obliquely conic-rostrate; spores mature in summer or in early autumn: paroicous or synoicous.

On wet, usually calcareous rocks, stones, walls, etc., widely distributed in the Old World and, in North America, occurring from Greenland to Alaska and south to the northern United States. Although not yet recorded from our region this species is to be expected here.

8. *BARBULA* Hedwig.

Dioicous; paraphyses filiform: more or less slender and densely and deeply cespitose, the tufts green to brownish: stems with central strand, thickly-leaved, forked; leaves erect-spreading, rarely recurved-squarrose, keeled, oblong to pro-

longed linear-lanceolate; with mostly revolute margins; costa strong, ending in the point, or excurrent; leaf-cells very small, thickened and opaque, papillose both sides; basal leaf-cells enlarged, quadrate to rectangular, colored: seta long, erect; capsule erect, rarely a little inclined, oblong to cylindric, straight or rarely a little arcuate; annulus distinct or none; peristome rarely rudimentary, or none; the teeth united below into a rather low basal membrane which is rather deeply inserted, the 32 teeth spirally one to several times dextrorsely wound, filiform; operculum conic-rostrate; calyptra cucullate, long-rostrate, reaching to about the middle of the urn; spores small.

A genus of 240 species distributed over the whole earth, on soil and rocks; about 70 species in North America; only two species definitely known from our region.

Key to the Species.

a. Perichætial leaves high-convolute-sheathing: seta yellowish or later reddish. 3. *B. convoluta.*

a. Perichætial leaves not as above: seta red or brown. b.

b. Stem-leaves obtuse, costa shortly mucronate-excurrent. 2. *B. unguiculata.*

b. Stem-leaves acute, costa not mucronate-excurrent. c.

c. Costa .070 mm. wide at base and tapering gradually. 1. *B. acuminata.*

c. Costa .050 mm. wide at base and of equal breadth to the middle. (*B. reflexa* Bridel).

1. **Barbula acuminata** Hedwig.

(*B. fallax* Hedwig).

Loosely and widely cespitose, brownish dull green: stems fastigiately branched, slender, 1–5 cm. high; leaves somewhat distant, recurved-spreading or arcuate, appressed and slightly twisted when dry, lanceolate-acuminate from the base, the base ovate, the leaves carinate and often faintly plicate below, the margin revolute in the lower half at least, entire; costa strong, ending in the apex; upper leaf-cells small, rounded to hexagonal, incrassate, strongly papillose, gradually larger below, and at the lowest part of the base a few elongate-rectangular and pellucid: seta reddish, capsule brownish, long-ovoid to sub-cylindric, mostly symmetric and erect; lid long, often as long as the urn, acutely rostrate-subulate; peristome-teeth reddish, long, filiform, dextrorsely much twisted, united at base into a low membrane; annulus none; spores mature from late fall to spring: dioicous.

On moist earth, rocks, walls, etc., usually on calcareous substrata, in Europe, Asia, northern Africa, and, in North America from the Arctic region south to the northern United States. To be expected in northern Pennsylvania.

2. **Barbula unguiculata** [Hudson] Hedwig.

(Plate XIII)

Densely cespitose, yellowish-green: stems erect, somewhat branching, usually about 1 cm. high; leaves about 2 mm. long, erect-spreading, somewhat recurved, when dry spirally imbricate and twisted, oblong-lanceolate, sometimes lingulate, obtuse, mucronate, entire, the margin recurved below, plane above; costa strong, excurrent and thus forming the rounded mucro; upper leaf-cells small, about .008–.010 mm., rounded-quadrate, incrassate, strongly papillose, obscure, the basal elongate-rectangular, yellowish-pellucid to more or less hyaline, the marginal not different; perichætial leaves longer and more erect: seta erect, castaneous, lustrous, about 1 cm. high, when dry sinistrorse; capsule oblong-cylindric, deep-castaneous, the urn about 1.8 mm. long, erect, exannulate, rather smooth when dry and empty; lid about one-third as long as urn, conic-rostrate, slightly curved or straight; the 16 peristome-teeth castaneous, pellucid, papillose, cleft to the base into 32 filiform divisions, from a narrow membrane at the base twisted into about two turns dextrorsely; spores smoothish, yellowish, about .009–.012 mm., mature from November to spring: dioicous.

A quite variable species occurring on moist earth, banks, stones, walls, etc., in Europe, Asia, northern Africa, and throughout southern Canada and northern United States. Common in our region.

Allegheny : Schenley Park, Pittsburgh, August, 1905. (Figured); Fern Hollow, Pittsburgh, January 21, 1906, and Powers Run, November 30, 1909. O. E. J.
Butler : T. P. James. (Porter's Catalogue).
Center : T. C. Porter. (Porter's Catalogue).
Huntingdon : T. C. Porter. (Porter's Catalogue).
McKean : West Branch Swamp, Bradford, April 10, 1894. D. A. B.
Westmoreland : T. P. James. (Porter's Catalogue).

3. **Barbula convoluta** Hedwig.

(Plate XIII)

Densely cespitose, yellowish-green: stems 1–3 cm. high, usually about 1–1.5 cm., erect, branching; leaves about 1–1.5 mm. long, when dry crisped, when moist erect-spreading, often somewhat recurved, lance-oblong to lance-linear or lingulate, rounded to obtuse, sometimes sub-acute, concave, the margins mostly plane or slightly recurved on one side at base, mostly minutely crenulate with bifid papillae; basal leaf-cells elongate-rectangular, pellucid to hyaline, rather incrassate, smooth,

median and upper leaf-cells small, sub-quadrate, densely papillose, strongly incrassate, often rather obscure; costa strong, yellowish-pellucid, ending below apex or rarely shortly apiculate-excurrent; perichætial leaves high-convolute-sheathing, the inner ecostate: seta erect, about 1.5 mm. long, yellow, or reddish when old, sinistrorse below, dextrorse above; capsule small, symmetric, erect, reddish-brown, narrowly oblong, the urn about 1.5 mm. long; lid conic-rostrate, oblique, about 1 mm. long, the cells spirally arranged; exothecial cells narrow, elongate-rectangular, brownish or yellowish pellucid, two or three series at the rim much smaller, sub-quadrate and darkly obscure; annulus distinct and narrow; peristome-teeth consisting of 32 filiform articulate divisions several times dextrorsely twisted from a low basal membrane; spores brownish-pellucid, medium-walled, smoothish, about .016–.018 mm., mature in spring: dioicous.

On soil, especially in calcareous districts, Europe, Asia, northern Africa, and from southern Canada to Alabama, Kansas, and California. In our region occurring at Latshaw, New York, (Figured) and as follows,—not common:

Lawrence : Enon Valley. T. P. James. (Porter's Catalogue).

Lycoming : McMinn. (Porter's Catalogue).

9. *PHASCUM* [Linnæus] Hedwig.

Autoicous or synoicous: very small, closely gregarious: stem short, without central strand, erect, simple or bushy-branched; leaves mostly ovate-lanceolate to elongate-lanceolate, mostly with entire and revolute margins, the upper mostly with a strong excurrent costa; upper leaf-cells quadrate to hexagonal, warty-papillose on both sides, rarely smooth; basal leaf-cells rectangular and hyaline: seta very short, sometimes curved; capsule immersed or slightly emergent, sometimes two in a perichætium, mostly globose and obtusely apiculate, with no indication of an operculum; calyptra cuculiate or rarely mitrate, small, conic.

A widely distributed genus of 22 species, on soil; 3 occurring in North America, one in our range.

1. Phascum cuspidatum [Schreber] Hedwig.

(*P. acaulon* Linnæus).

Cespitose, deep green: stems short, 1–2 mm. high, simple or forked; leaves crowded, erect, the comal largest, oblong-lanceolate, acuminate, more or less carinate, entire, revolute towards middle; costa excurrent; basal leaves lax, hyaline, the upper rectangular to hexagonal, .015–.030 mm., finely dorsally papillose: seta short, straight or curved; capsule globose, sometimes two or three on the same plant, immersed or rarely

emergent, obtusely apiculate, cleistocarpous; calyptra cucullate, conic, covering only the upper portion of the capsule; spores large, .028–.035 mm., yellowish-pellucid, finely roughened, mature in spring: autoicous or paroicous, antheridia clustered in the axils of the upper leaves.

On soil in old fields, pastures, etc., usually preferring a sandy soil, in Europe, Asia, Algeria, South America, and from Ontario to the Carolinas and west to the Pacific States. Rarely found in our region.

Beaver : T. P. James. (Porter's Catalogue).

10. *POTTIA* Ehrhart, Fuernrohr.

Autoicous or paroicous, rarely synoicous or dioicous: small, gregarious to cespitose, green to brownish or whitish: stem with central strand above, often simple, radiculose at base, leafy; leaves tufted above, spreading to imbricate, carinate to deeply concave, oblong to elongate-lanceolate, or spatulate, acuminate to piliferous, rarely obtuse, margin revolute or plane; costa without lamellæ, complete to excurrent, rarely incomplete; lower leaf-cells elongate, pellucid, smooth, the upper rounded-quadrate or rounded-hexagonal, mostly papillose on both sides: seta mostly long and straight; capsule exserted or rarely immersed, erect, symmetric, short-necked; annulus none or deciduous or remaining attached; peristome often none or rudimentary, when present of 16 perforate or upwards 2–3-cleft teeth upon a basal membrane, articulate; operculum mainly obliquely rostrate, rarely conic-obtuse, sometimes not deciduous; calyptra cucullate, papillose or smooth, usually falling away with the operculum; spores large, variously papillose or pitted.

A genus of about 62 species widely distributed, on soil or soil-covered rocks, mainly in the temperate zones; 12 species in North America, 1 species in our region.

1. **Pottia truncata** [Hedwig] Fuernrohr.

(*P. truncatula* Lindberg; *Gymnostomum truncatum* Hedwig).

(Plate XIII)

Densely cespitose, dull green: stems simple or sparingly branched, erect, about 2.5 mm. high, radiculose at base; leaves numerous, the upper much larger than the lower, obovate to oblong-spatulate, about 1.5–2.5 mm. long, soft, spreading, the margins plane, minutely crenulate with the projecting transverse cell-walls, the leaves when dry become twisted, apex abruptly acute, costa strong and excurrent into a short point; basal leaf-cells quadrate to rectangular, large, lax, hyaline, more or less inflated, above becoming gradually smaller, the median and upper medium- to thin-walled, smooth, hexagonal: seta erect, about 3–4 mm. high, mostly yellowish; capsule

broadly oval or turbinate, erect, symmetric, about 0.6–0.8 mm. high, exannulate, more or less castaneous, when dry and empty smooth and turbinate-hemispheric; lid broadly convex to flattish with a beak about one-half as long as the urn; exothecial cells medium-walled, castaneous, pellucid, irregularly quadrate to rectangular, the upper two or three rows at the rim much smaller, rounded-quadrate, obscure; spores orange-pellucid or brownish-pellucid, minutely punctulate, large, .026–.030 mm., mature from autumn to spring.

On moist soil in grasslands, along streams, etc., Europe, Asia, northern Africa, and from Ontario to New England and Pennsylvania, and in Nevada. Rare in our region.

McKean : Corydon Street, Bradford. D. A. B. (Figured).

11. *DESMATODON* Bridel.

Autoicous: slender plants in mostly low, soft, green to yellow-green tufts, dense to loose: stem mostly with central strand, thickly foliate, forking; leaves when dry appressed and more or less plicate, when moist erect-spreading, carinate to concave, obovate to ovate or lance-linear, mostly with recurved margins below, plane above, above often serrate, sometimes margined; costa mucronately or aristately excurrent, both costa and lamina papillose; leaf-cells loose, thin-walled, above rounded-quadrate or more or less hexagonal or rhomboidal, below rectangular and long-hexagonal, hyaline, smooth: seta elongate, mostly straight; capsule erect, inclined, or even pendent, mostly symmetric, ovate to cylindric; annulus persistent or falling away in pieces; peristome inserted below the rim of urn, the basal membrane forming a tube which is slightly exserted from the urn, thickly articulate, teeth rather broad, divided to the base into two or three flat, filiform, papillose, divisions, united here and there, usually twisted; lid stoutly and obliquely rostrate, with the cells more or less spirally arranged; calyptra cucullate, smooth, long-rostrate; spores large.

A small genus of 7 species, mainly on rich humus-soil in the mountains; one species in our region.

1. **Desmatodon arenaceus** Sullivant.

(*D. ohioensis* Schimper; *Didymodon arenaceus* Kindberg).

(Plate XIII)

Gregarious to loosely cespitose, bright yellowish-green: stems short, in our specimens about 3 mm. long, radiculose at base; leaves erect-spreading when moist, crisped when dry, very small below but increasing to form a comal tuft above, from ovate to lance-ovate, the comal 2–3 mm. long, bluntly acute, short-apiculate, the margin minutely crenulate and more

or less revolute; costa strong, reaching the apex or extending into the apiculation; upper leaf-cells opaque, incrassate, papillose, from rounded to hexagonal or quadrate, towards the base of the leaf becoming elongate, thin-walled and hyaline: seta erect, 6–8 mm. high, sub-lustrous, sinistrorse, castaneous; capsule dark-castaneous, oblong, 12–15 mm. long; peristome-teeth yellow, slender, divided almost to the base into two slender, minutely-papillose prongs; annulus distinct, revoluble; operculum bluntly and obliquely conic-rostrate; exothecial cells brownish-incrassate, rectangular or oblong-hexagonal, immediately below the annulus being smaller and incrassate; spores smoothish, yellowish, .012–.015 mm., mature in spring.

On sandy soil, rocks, etc., mainly confined to the drainage-system of the Ohio River. Not rare in our region.

Crawford	: Linesville, May 12, 1908. O. E. J. (Figured).
Fayette	: Along river-bank at Ohio Pyle, September 1-3, 1907. O. E. J. and G. K. J.
McKean	: Near Bradford, December 15, 1894. D. A. B.

12. *TORTULA* Hedwig.

Autoicous or dioicous, rarely synoicous or polyoicous: small to robust, in green to brown tufts or cushions: stems mostly with a central strand, below brownish- or red-radiculose, simple or branched; leaves mostly larger at the ends of the shoots, often appearing rosette-like, when dry not crispate but somewhat twisted and contorted, when moist erect-spreading, mostly keeled, obovate or spatulate, rounded at the apex or rarely short-acute, commonly bordered, usually entire; costa strong, often cylindric, often mucronate-excurrent or, more commonly, excurrent into a hyaline hair-like awn; upper leaf-cells rounded-hexagonal, loose, chlorophyllose, papillose, grading below into the rectangular to elongate hyaline basal cells: seta long, erect; capsule erect, cylindric, symmetric, short-necked, straight or sometimes slightly arcuate; annulus present; peristome single, rarely none, basal membrane low to high, teeth 32, filiform, equally spaced, mostly once to twice dextrorsely wound, papillose and transversely striate, articulate; operculum conic, obliquely rostrate; calyptra cucullate, reaching to the middle of the urn; spores small.

A large genus of 202 species, widely distributed in the temperate regions; 40 species occurring in North America; only 1 species thus far reported in our region.

Key to the Species.

a. Small; leaves when dry contorted and twisted: basal membrane low. b.

a. Medium to robust; basal membrane high and tessellated. d.

b. Teeth rather short, erect or slightly wound. c.

b. Teeth long, once to several times wound. (*T. muralis* [Linnæus] Hedwig.)

c. Cells of leaf-margin not distinctly differentiated into a border. (*T. plinthobia* [Sull.] Broth.)

c. Cells distinctly differentiated at margin into a border. (*T. porteri* [James and Aust.] Broth.)

d. On trees; leaves deeply concave, margins involute; costa spinulose-aristate. 1. *Tortula papillosa.*

d. On soil or stones; leaves not deeply concave; margins not revolute; costa smooth-cuspidate. (*T. ruralis* [Linn.] Bryol. Europ.)

1. **Tortula papillosa** Wilson, mss., Spring.

(*Barbula papillosa* C. Mueller).

Loosely cespitose, green, brownish in drying: stem short, up to 1 cm.; leaves erect-spreading, when dry appressed but scarcely twisted, broadly obovate-spatulate, fiddle-shaped (panduriform), with margins involute, the apex rounded to short-acute; costa thick and spongy, dorsally papillose, above ventrally often bearing numerous shortly pedicellate multicellular gemmæ, excurrent-mucronate or cuspidate; basal leaf-cells rectangular, a few hyaline, upper leaf-cells pellucid, incrassate, more or less collenchymatous, large, ventrally smooth, dorsally simply papillose: capsule, known thus far only from Australia and New Zealand, reddish-brown, short, with a short seta.

On tree-trunks (In America often on elms), rarely on rocks in open places, South America, New Zealand, Australia, Europe, and, in North America, in the Atlantic States from Delaware to Massachusetts and Pennsylvania. Rare and always sterile in our region.

Blair : Tyrone, T. P. James. (Porter's Catalogue).

Family VI. *ENCALYPTACEAE.*

Autoicous, rarely dioicous: robust, usually densely cespitose, bright green, the inside of the cushions rust-colored: stem 3–5-angled with little or no central strand, erect, brown-radiculose, thickly-leaved, branched dichotomously; leaves erect-spreading, when dry folded and twisted, more or less lingulate, acute to obtuse, margins plane to undulate; costa highly developed, usually percurrent to very shortly excurrent, prominent dorsally and dorsally papillose or toothed; cells in upper two-thirds of leaf rather symmetrically hexagonal, chlorophyllose, opaque, thickly papillose on both sides, in the

lower third the cells much larger, without chlorophyll, rectangular to rhombic, hyaline or slightly colored, smooth, bordered by a few rows of narrow, elongate, and yellowish cells: seta long, erect; capsule erect, symmetric, cylindric, smooth or plicate, mostly with a short neck; annulus present; peristome varying from none to well-developed, usually of 16 teeth; operculum from a conic base very long and slenderly erect-rostrate; calyptra cylindric-campanulate ("extinguisher-like"), long-rostrate, straight, completely enclosing the capsule, the border fringed; spores large and papillose.

A world-wide family mostly on soil and rocks, occurring in the tropics, however, only on the higher mountains. At least 40 species; about 20 species occurring in North America; 2 in our region. The family embraces but one genus, with characters as given for the family:

1. *ENCALYPTA* Schreber, Hedwig.

Key to the Species.

a. Monoicous: no gemmæ: peristome single; capsule smooth. 1. *E. ciliata.*

a. Dioicous: clusters of slender brown gemmæ in axils of leaves: peristome double; capsule spirally striate. 2. *E. streptocarpa.*

1. **Encalypta ciliata** Hedwig.

(*Leersia laciniata* Hedwig; *Leersia ciliata* Hedwig).

Loosely cespitose, bright green: stems branched, 1–2.5 cm. high, densely radiculose below; leaves large, broadly obovate-oblong to lingulate, rounded at apex, apiculate, plane-margined and narrowly recurved below, spreading when moist, crisped and incurved when dry; costa yellowish, ending just below apex or percurrent; basal cells lax, hyaline, rectangular, walls red, the marginal paler and narrower in several rows, the upper leaf-cells opaque, densely papillose, hexagonal-quadrate, the walls pellucid, cells about .015 mm. across: seta long, erect, yellowish to reddish, dextrorse; capsule cylindric, reddish-brown, smooth, constricted below mouth and smooth when dry, at base abruptly tapering into the seta; peristome single, the teeth 16, lanceolate, reddish, inserted below the rim, irregulary divided in some specimens, papillose, articulate, strongly incurved when moist; annulus none; exothecial cells smaller in several rows at the rim; lid erect, nearly as long as urn, narrow, slenderly rostrate-clavate; calyptra straw-colored, mitrate, cylindric, slenderly rostrate, extending below the base of capsule, the lower margin fringed with a row of narrowly lanceolate teeth; spores roughened, mature in late summer or early fall: autoicous.

In crevices or shaded places on rocks and walls, almost cosmopolitan in mountainous or hilly regions; in North

America from the Arctic region south to the northern United States. Reported from the adjacent states of New York and Ohio and to be expected from the northern part of our range.

2. **Encalypta streptocarpa** Hedwig.

(*E. contorta* Lindberg).

Densely cespitose, dull or yellowish-green; stems large, 3 to 6 or 7 cm. high, branched, densely radiculose at base; leaves rather crowded, spreading, when dry more or less twisted and crisped, large, 5–6 mm. long, oblong-lingulate, sometimes narrowed in the middle, undulate, plane-margined, often incurved and sub-cucullate at apex; costa strong, reddish, ending below apex, dorsally scabrous; basal leaf-cells hyaline, rectangular, the marginal narrower, often forming a distinct yellowish border of a few rows of cells, upper leaf-cells hexagonal-quadrate, about .015 mm., papillose, incrassate-pellucid, usually regularly seriate; perichætial leaves oblong, abruptly long lanceolate-acuminate: seta long, red; capsule long, cylindric, dextrorsely orange-striate, furrowed when dry; peristome double, the teeth filiform, papillose, articulate, red, the inner peristome of 16 or 32 filiform pale segments half as long as the teeth and adherent to the latter by the broad punctulate basal membrane; lid narrow, long, rostrate, erect; calyptra very long, cylindric, scabrous at the tip of the long and slender beak, extending considerably below the capsule and laciniate at the border; spores mature in late summer; dioicous.

On rocks, walls, earth, etc., usually on calcareous substrata, mainly confined to rough country. Europe, Asia, and from Ontario and Virginia to California. Not yet found fruiting in North America. Rare in our region.

Cambria : Cresson. T. P. James. (Porter's Catalogue).

Famiy VII. *GRIMMIACEAE.*

Autoicous or dioicous: cespitose, dark green to blackish: stem mostly without central strand, radiculose only at the base, branches mostly of equal height, leaves often hyaline-pointed, often piliferous, but rarely crispate, when damp more or less spreading, rarely secund, mostly lanceolate, rarely and then only upwards denticulate, towards the apex and at the margin two to several cells thick, sometimes papillose; costa complete or nearly so, cells small, often sinuate-walled, above mostly rounded-quadrate, towards the base inflated and mostly pellucid, rectangular to elongate, rarely linear throughout the whole leaf: seta rarely shorter than the capsule; capsule mostly symmetric, globose to cylindric, mostly smooth, often immersed or emergent; annulus present, or none at all; teeth 16, mostly separate to the insertion, red to orange, papillose, plane,

undivided or cleft or cribrose, rarely divided to the base into filiform parts, trabeculæ mostly projecting only outwards; operculum mostly rostrate, sometimes deciduous with the attached columella; calyptra mostly small, mitrate or cucullate, glabrous, sometimes campanulate and plicate.

A large family, world-wide in distribution, but most abundant in sub-arctic and temperate regions, mostly on stones or rocks, rarely on soil or trees.

Key to the Genera.

a. Costa with basal guides, or homogeneous; calyptra rarely campanulate; spores small to medium-sized. b.
a. Costa with several median guides; spores small; calyptra campanulate. 1. *Glyphomitrium.*
b. Teeth undivided, cribrose, cleft in upper half, or none; branches as high as the stem. 2. *Grimmia.*
b. Teeth divided almost to the base into two filiform divisions; branches irregular and short. 3. *Rhacomitrium.*

1. **Glyphomitrium** Bridel.

(*Ptychomitrium* Fuernrohr).

Autoicous: cespitose in loose yellowish-green to brownish or blackish cushions; stem with central strand, erect or ascending, radiculose at the base, thickly-leaved; leaves long, narrow, the points not hyaline, crispate when dry, spreading when moist; costa strong, percurrent or ending below the apex; cells not with sinuose walls, smooth, upwards small and rounded-quadrate, below linear to more or less loosely rectangular; perichætial leaves not sheathing: seta straight, more or less elongate, mostly two or more to a perichætium; capsule smooth, erect, symmetric, mostly oval to oblong-elliptic; annulus wide, deciduous, rarely none; peristome inserted below the mouth; teeth papillose, usually deeply divided into two subulate prongs, trabeculæ more or less distinct; spores small; operculum conic with a long, fine, straight beak; calyptra campanulate, plicate and lobed.

A widely distributed genus of 66 species, of which at least 9 occur in North America and one in our region. Occurring on rocks and stones,—rarely on trees.

1. **Glyphomitrium incurvum** (Schwaegrichen) Brotherus.

(*Ptychomitrium incurvum* Sullivant).

Densely cespitose, dark green to brownish: stems about 5 mm. high, erect; leaves erect-spreading when moist, sometimes incurved, twisted-crispate when dry, the lower small, increasing in size upwards, linear-lanceolate, obtuse, thick, opaque, the margin plane; costa broad, ending in apex; basal leaf-cells rectangular, pellucid, the upper much smaller, rounded to quadrate, incrassate, dense; seta about 3–4 mm. high, erect;

capsule erect, oval; peristome-teeth 16, long-subulate, articulate, papillose; lid erect, conic-subulate, about as long as urn; calyptra long-rostrate, mitrate, plicate-lobed to base of beak, covering a little more than half of the urn; spores mature in spring.

On more or less exposed calcareous rocks from Connecticut to Georgia and Texas. Not uncommon in Eastern Pennsylvania, Northern Ohio, and Western New York, and probably will be found eventually in our region.

2. *GRIMMIA* Ehrhart, Hedwig.

Autoicous or dioicous: forming cushions and mats, slender, often hoary by reason of the hyaline leaf-apices: stem erect or ascending, mostly with a central strand, radiculose mainly at the base, thickly-leaved; leaves imbricate when dry, rarely crispate or spirally appressed, spreading to recurved-squarrose when moist, lower often small and bract-like, the upper often suddenly larger, often hyaline-piliferous, carinate, concave, sometimes canaliculate, mostly lanceolate from an oblong or ovate base, acuminate, entire, margins plane or revolute; costa complete or extending to the base of the piliferous apex; upper cells small, rarely papillose, rounded-quadrate, often opaque, looser towards the middle, the basal linear to rectangular and sometimes forming a colored border; perichætial leaves mostly larger, more or less sheathing, areolation looser: seta sometimes shorter than the capsule, rarely much longer than the perichætial leaves, arcuate or straight, mostly yellow, twisted when dry, capsule mostly symmetric, smooth to ribbed, globose to cylindric; annulus persistent or curling off, sometimes none; peristome rarely absent, when present inserted below the mouth; teeth reddish-brown, broad to subulate, entire to cribrose, sometimes cleft to the middle, the trabeculæ projecting outwards; operculum often rostrate, never longer than the urn; calyptra lobed-mitrate to cucullate, long-rostrate, smooth; spores small.

A large genus of world-wide distribution, but mainly confined to the mountains of the tropics, occurring on rocks and stones. About 240 species, of which some 70 occur in North America and at least 4 in our region.

Key to the Species.

a. Seta not longer than the capsule; operculum mostly falling with the columella still attached. b.
a. Seta longer than the capsule. f.
b. Apices of upper leaves with short hair-points. c.
b. Apices of upper leaves long-piliferous. e.
c. Lower leaf-cells with sinuouse walls. 4. *G. pennsylvanica.*
c. Lower leaf-cells not with conspicuously sinuose walls. d.

d. Slender small plants in dense cushions; central strand in stem; teeth decidedly cribrose. 2. *G. conferta.*
d. More robust, loosely cespitose; no central strand; teeth slightly cribrose. 1. *G. apocarpa.*
e. Leaf-cells without sinuose walls; capsule oblong. (*G. ambigua* [Sullivant] Sullivant.)
e. Leaf-cells with somewhat sinuose walls; capsule oblong-ovate. 3. *G. pennsylvanica.*
f. Capsule distinctly ribbed; seta curved; leaf-margins of a single layer of cells. (*G. olneyi* Sullivant.)
f. Capsule smooth, seta straight; upper leaf-margins of more than one layer of cells. g.
g. Leaves lanceolate, tapering; basal leaf-cells thin-walled and elongate-rectangular, about 1:4 to 1:8, alpine. (*G. obtusa* Schwaegrichen; *G. doniana* Smith.)
g. Leaves oblong-lanceolate, the long apex rough, piliferous; basal leaf-cells more or less quadrate. 4. *G. laevigata.*

1. **Grimmia apocarpa** [Linnæus] Hedwig.

(Plate XIV)

Loosely cespitose, more or less erect, branching rather freely, about 2 cm. high, dull olive-green, drying stiff and noncrisped: leaves ovate-lanceolate, erecting-spreading, strongly costate and usually more or less carinate, margin narrowly recurved, apex narrowly obtuse, leaves about 2 mm. long; perichætial leaves similar but somewhat longer and thinner; costa ending in or just below the apex, terete dorsally; basal cells rectangular, about .008–.010×.015–.030 mm., upper basal cells quadrate, and in our specimens usually sinuose-walled, the median and upper cells rounded and .005–.009 mm. in diameter, all cells incrassate and more or less opaque: seta erect, stout, about 0.5 mm. long; capsule immersed, oval-oblong, about 1 mm. long, reddish-brown, rather thick-walled, smooth; calyptra short, lobed; operculum low-conic, rostrate; peristome single, teeth 16, lance-linear, trabeculate, somewhat cribrose, reddish-brown, faintly papillose, when dry reflexed-revolute; spores reddish-brown, in our specimens about .012–.018 mm. in diameter; columella falling away with the operculum and remaining attached to it; spores mature in late spring.

On stones, hard earth, etc., with a wide distribution over the colder regions of the earth. In America occurring from Alaska and Newfoundland to the Northern States and south in the mountains to Georgia.

Fayette : Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
McKean : D. A. B. (Porter's Catalogue).
Washington : Linn and Simonton. (Porter's Catalogue).

Westmoreland : Shaly bank of stream, in Shades, Trafford City, March 25, 1910. O. E. J. (Figured).

2. **Grimmia conferta** Funck.

Densely cespitose, in gray-green rounded cushions: stems slender; leaves lance-ovate to oblong, acuminate, opaque, apex hyaline, denticulate; costa strong, dorsally prominent, ending at apex; basal leaf-cells rectangular to quadrate, the upper smaller and rounded, all incrassate and dense: seta short; capsule immersed, ovate-globose, wide-mouthed, hemispheric and somewhat wrinkled when dry; peristome-teeth light reddish-brown to orange, fragile, markedly cribrose; annulus said to be none; lid wide, low-convex, apiculate; spores mature in spring.

On rugged exposed rocks, Europe, Asia, and Africa, and, in North America, from Nova Scotia to British Columbia south to Idaho and Pennsylvania.

Washington : Linn and Simonton. (Porter's Catalogue).

3. **Grimmia pennsylvanica** Schwaegrichen.

(*Grimmia pilifera* Beauvois).

Densely cespitose, dark green: stems 1 to 3 cm. high, robust, rigid, branching; leaves close, narrowly ovate-lanceolate, acuminate, concave, the apex rough, acute to short piliferous; margins strongly recurved below and thickened above; basal leaf-cells linear-rectangular 3–6:1, thin-walled, hyaline to yellow-pellucid, shortly above base the cells incrassate-sinuous, short-rectangular, the upper rounded-quadrate to hexagonal, small, incrassate, very dark; costa strong ending in apex; perichætial leaves piliferous: seta about half as long as urn, capsule more or less completely immersed, oblong-ovate, smooth, even when dry, lid conic-rostrate, about three-fifths as long as urn, erect; annulus large; peristome-teeth large, broadly lanceolate, irregularly split and cribrose to about the middle, castaneous pellucid; calyptra lobed, mitrate; spores mature in the autumn but often not shed till spring: dioicous.

On moist rocks in woods, Japan and, in North America, from Nova Scotia to Georgia and Minnesota, and in Mexico. Reported in our region only from Painesville, Ohio. (W. C. Werner.)

4. **Grimmia laevigata** (Bridel) Bridel.

(*G. campestris* Burch.; *G. leucophaea* Greville).

Cespitose loosely in wide, dull green tufts; hoary above: stems stout, branched; leaves close, larger towards top of stem,

when dry imbricate-appressed, very concave, oblong-oval to rather widely ovate, 1–1.5 mm. long, plane-margined, at the apex abruptly terminating in a long, flattened, finely denticulated hair, which is decurrent along the upper margin of the lamina, and is often longer than the lamina; the smaller lower leaves acuminate but without the hair-point; costa narrow, ending in the apex; basal leaf-cells quadrate, except a few rectangular ones near the costa, the upper smaller and rounded, all incrassate, non-sinuose, the upper quite chlorophyllose: seta erect; capsule included, elliptic, broadly oblong, brownish smooth when dry; annulus large; lid conic-rostellate, short, peristome-teeth cleft to about the middle, cribrose below, castaneous-pellucid; calyptra mitrate, lobed; spores mature in spring.

On rocks, mainly non-calcareous, often granite or sandstone, almost cosmopolitan. In North America from Pennsylvania to Minnesota, Kansas and the Pacific States. Rare in our region.

Blair : Tyrone, T. P. James. (Porter's Catalogue).

3. *RHACOMITRIUM* Bridel.

Dioicous: robust plants, loosely and widely cespitose, the mats green to yellowish or blackish-green: stem without central strand, procumbent to erect, radiculose at the base only, uniformly foliate, often with numerous short branches giving the shoot a nodose appearance; leaves spreading to recurved-spreading or sometimes secund, when dry appressed, from an ovate to oblong base mostly lanceolate to lance-linear, more or less long-acuminate, often piliferous, sometimes lingulate and obtuse, margins sometimes 2-layered and sometimes recurved; costa mostly broad, flat, and complete; cells nearly all with sinuose walls, often papillose, towards the base or sometimes all over linear: seta long, straight, rarely curved, twisted; capsule erect, oblong to cylindric, narrow-mouthed, smooth; annulus broad, curling off; teeth united at the base but mostly cleft deeply into 2 (–3–4) filiform divisions, often very long, trabeculate; spores small; operculum conic with a long subulate apex from one-third to more than the length of the urn; calyptra mitrate, lobed, not folded, subulate-rostrate, glabrous or rough.

A world-wide genus of 88 species, mostly on siliceous rocks; 23 species in North America, probably 3 species in our region.

Key to the Species.

a. Upper leaf-cells quadrate, lower ones linear; shoots not appearing nodose by arrangement of short lateral branches.
b.

a. Upper leaf-cells elongate; shoots appearing nodose with short lateral branches. c.
b. Leaves lingulate, leaf-apex broad, rounded. 1. *R. aciculare*
b. Leaves lanceolate-acuminate, at apex hyaline-acuminate. 2. *R. microcarpum.*
c. Leaf-apex obtuse, non-hyaline. (*R. fasciculare* [Schrader] Bridel.)
c. Leaf-apex hyaline, acuminate to piliferous. 3. *R. ericoides.*

1. **Rhacomitrium aciculare** [Linnæus] Bridel.

(*Dicranum aciculare* Hedwig).

(Plate XIV)

Cespitose in coarse tufts, dark dull green to blackish: stems long, up to 6 or 8 cm. long, stout, branching by short innovations, radiculose below; leaves erect-spreading, stiffly imbricate when dry, large, up to 1 mm. wide by 2.5 mm. long, broadly ovate-oblong, usually somewhat plicate at the base, the margin usually revolute, the apex broadly obtuse, denticulate to entire, non-hyaline, the upper margin usually thickened; costa strong, ending below apex; leaf-cells densely yellowish-pellucid, incrassate, sub-papillose, the upper sub-quadrate to rounded-hexagonal and in two layers at the margin, the basal elongate-rectangular to linear, markedly sinuose-incrassate, at the margin sub-quadrate, the alar a little larger, quadrate: seta erect, straight, about 10–12 mm. long; capsule dark brown, erect, oblong-cylindric to elliptic, smooth, with narrow mouth; peristome-teeth cleft to below the middle into 2 or 3 unequal divisions; lid aciculate-rostrate or subulate, almost as long as urn; calyptra smooth, long-rostrate, mitrate, lobed, covering only the top of capsule; annulus rather large, revoluble; spores mature in spring; fruit rarely found.

On wet, shaded, non-calcareous rocks in hilly or mountainous country, in Europe, Africa, and, in North America, from Alaska to Labrador south to California and Alabama. Occurs in northern West Virginia and as follows:

Cambria: : James. (Porter's Catalogue).
Fayette : Ohio Pyle, in crevices of rock along the Youghiogheny river near the Falls, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

2. **Rhacomitrium microcarpum** (Hedwig) Bridel, not Schrader.

(*Rhacomitrium sudeticum* Bryologia Europæa; *Trichostomum microcarpum* Hedwig).

Loosely cespitose, dull or yellowish-green above: stem slender with ascending branches, 2–5 cm. high; leaves divaricately spreading, erect when dry, narrowly lanceolate, linear-

acuminate, apex hyaline, denticulate, margin more or less bistratose above, usually revolute below; costa strong, ending in apex; basal leaf-cells linear, sinuose, incrassate, upper leaf-cells rounded-quadrate: seta short, light-colored, often curved or flexuose; capsule relatively very small, elliptic, pale brown, thin-walled; annulus large, revoluble; peristome-teeth brownish, irregularly divided; lid conic-rostrate, shorter than the urn; spores mature in spring.

On wet rocks or cliffs, principally granite or gneiss, Europe, Asia, and, in North America, from Greenland to British Columbia, south to Oregon and northeastern United States. Perhaps to be expected in the eastern or northeastern part of our region.

3. **Rhacomitrium ericoides** (Schwaegrichen) New Combination.

(*Trichostomum ericoides* Schwaegrichen; *Dicranum microcarpum* Schrader).

Cespitose in low, green to yellow-green tufts: stems slender, markedly nodose with obtuse lateral innovations; leaves crowded, spreading to falcate-secund, lanceolate from an ovate base, acuminate, the apex hyaline, flat, denticulate, not very narrow, margin revolute, not thickened; costa strong, ending in the apex; leaf-cells all linear, the upper 3–6:1, incrassate, sinuose, the marginal shorter and in the alar portion often a few larger, rectangular, pellucid, and not sinuose-walled: seta yellowish, short; capsule small, elliptic-cylindric to oblong, pale yellow-brown, thin-walled; annulus large, revoluble; peristome-teeth short, divided almost to the base; calyptra somewhat papillose at the apex; lid short-rostrate; spores mature in spring.

On exposed rocks and stones in hilly or mountainous regions, Europe, and, in North America, from Greenland to British Columbia south to Oregon and eastern Pennsylvania. Perhaps will be found in the eastern part of our region.

Family VIII. *ORTHOTRICHACEAE.*

Dioicous or autoicous, rarely heteroicous or polyoicous: cespitose, light green to yellowish- or blackish-green outside the tufts, inside brown to black: stem mostly with no central strand, erect to ascending, or creeping with erect or ascending branches, radiculose below, or along the creeping stem, with reddish or brownish filaments; leaves spreading to squarrose, carinate, mostly from a decurrent base more or less lanceolate, sometimes oblong-lingulate to linear, mostly entire, usually papillose both sides; costa strong, sometimes excurrent-aristate or piliferous; upper cells generally rich in chlorophyll, round-quadrate to round-hexagonal, basal mostly elon-

gate-rectangular to linear, pellucid; perichætial usually more or less sheathing: seta erect; capsule erect, symmetric, collum distinct, oval to pyriform or cylindric, smooth or striate, deeply plicate when dry and empty; annulus persistent; peristome mostly double, rarely none; teeth 16 united or approximate in 8 pairs, lanceolate, flat, whitish to yellowish or reddish, reflexed when dry, exteriorly papillose or transversely, obliquely, or longitudinally striate, rarely smooth, rather delicately trabeculate; inner peristome of 8 or 16, filiform, or lanceolate, glabrous or papillose segments alternating with the teeth; spores small to very large; operculum long-rostrate; calyptra cucullate and usually smooth to campanulate, often plicate and hairy.

A rather large family of mostly tree-inhabiting species, mostly of temperate regions.

Key to the Genera.

a. Calyptra cucullate, not plicate; stems erect or creeping. b.

a. Calyptra mostly campanulate, plicate; stems mostly erect. c.

b. Stem erect: peristome none. 1. *Amphidium.*

b. Stem creeping with erect or ascending branches: peristome single. 2. *Drummondia.*

c. Leaves when dry crispate, at the base ovate and mostly with a hyaline border: capsule exserted in our species. 4. *Ulota.*

c. Leaves not crisped when dry, not ovate at the base nor with hyaline border: capsule immersed or emergent in our species. 3. *Orthotrichum.*

I. *AMPHIDIUM* (Nees) Schimper.

(*Amphoridium* Schimper; *Zygodon* Authors).

Autoicous or dioicous: tufts cushion-like, soft, often extensive, yellowish olive-green to blackish, inside rusty brown: stem furcately branching, uniformly foliate, radiculose to the apex with smooth filaments; leaves linear-lanceolate, papillose both sides, when dry contorted or crispate; costa practically complete, with median guides; leaf-cells thick-walled, angular to roundish, green, towards the base generally elongate, rectangular, thin-walled to hyaline; perichætial leaves erect, longer, sheathing or half-sheathing: seta short, generally erect, thickening above and grading into the long collum; capsule emergent to exserted, mostly erect, pyriform, with 8 projecting, reddish-brown ribs, when empty much widened at the mouth and urceolate; annulus none; peristome none; operculum obliquely rostrate from a low-conic base; calyptra cucullate, glabrous, not plicate.

A world-wide genus of 16 species, on mainly non-calcareous rocks; 7 species in North America; 2 in our range.

Key to the Species.

a. Autoicous: leaf-margins plane: seta 1.5 mm. long or less; beak of operculum shorter than radius of capsule. 1. *A. lapponicum.*
a. Dioicous: leaf-margins recurved below: seta about 3 mm. long; beak of operculum longer than radius of capsule.
2. *A. mougeotii.*

1. **Amphidium lapponicum** (Hedwig) Schimper.

(*Anictangium lapponicum* Hedwig; *Zygodon lapponicus* Bryologia Europæa).

Densely cespitose, dark olive-green above, blackish below: stems dichotomously branching, usually 1–3 cm. high; leaves flexuous-spreading, lance-oblong to lance-linear, 1.5–2.0 mm. long, margins plane, acute, crisped when dry; costa strong, ending below apex; basal cells large, thin-walled, pellucid to hyaline, the upper small, quadrate-hexagonal, rather obscure, incrassate, papillose; perichætial leaves sheathing: seta very short, usually not over 1.5 mm.; capsule oval with distinct collum about as long as sporangium, partially immersed, brownish, when dry constricted below mouth, urceolate, with 8 reddish striæ, the mouth forming a deep red, thickened rim; no peristome; lid red, lustrous, small, low-conic, obliquely rostellate, the length of the beak not more than one-half the diameter of the capsule; calyptra cucullate, small, reaching about half-way down the urn, brownish; spores mature in early summer: autoicous, the antheridial flowers axillary along the stem.

In crevices of shaded rocks, rarely in calcareous habitats; Europe, Asia, and, in North America, from Greenland to British Columbia south to northern United States and to California. Rare in our region.

Huntingdon : Porter. (Porter's Catalogue).

2. **Amphidium mougeotii** (Bryologia Europæa) Schimper.

(*Zygodon mougeotii* Bryologia Europæa; *Anoectangium mougeotii* Lindberg).

Densely cespitose, in large tufts, yellowish-green above, rusty to blackish below: stems usually 2–6 cm. high, dichotomously branching; leaves spreading or erect-spreading, crisped when dry, elongate lance-linear, acuminate, carinate, margin narrowly revolute below, slightly irregular above; costa strong, vanishing at apex; basal leaf-cells narrowly rectangular, rather thick-walled, above shorter, sub-quadrate to rounded, incrassate, hardly papillose, pellucid; perichætial leaves sheathing only the base of seta: seta about 2–3 mm. long; capsule shortly exserted, narrowly oval with a distinct neck, when dry urceolate, contracted below mouth, 8-striate: peristome none; lid low, obliquely rostrate, the length of the beak more than

one-half the radius of the capsule: calyptra cucullate; spores mature in summer or early autumn: dioicous: fruit rare.

On damp, shaded, usually non-calcareous rocks, in mountains or hilly regions; in Europe, Asia, and in North America, from Newfoundland to Alaska south to Alabama and Oregon. To be looked for in the eastern part of our range.

2. *DRUMMONDIA* Hooker.

Autoicous or dioicous: slender, in low, dense, green, scarcely shining, often extensive mats: stem long, creeping, brown-radiculose, thickly covered with short, erect, simple or furcate branches; leaves when dry stiffly appressed, when moist erect-spreading to spreading, ovate-lanceolate to linear-oblong, acute or obtuse, entire; costa strong, almost percurrent; cells uniformly rounded, smooth, chlorophyllose: seta erect, long; capsule erect, symmetric, oval, smooth, when dry shriveled; annulus none; peristome simple, inserted below urn-mouth; teeth 16, very short, truncate, entire, smooth, densely trabeculate; spores very large (.08–.10 mm.); round or oval, several-celled, green, smoothish; operculum obliquely rostrate; calyptra cucullate, large.

A small genus of 6 species, on trees, rarely on rocks; mostly Asiatic, one in our region.

1. **Drummondia prorepens** [Bridel] New Combination.

(*Anodontium prorepens* Bridel; *Gymnostomum prorepens* Hedwig; *Hypnum clavellatum* Dillenius; *Orthotrichum clavellatum* Hooker).

(Plate XIV)

Stems creeping, radiculose on the under side, with numerous short, erect branches, 6–10 mm., forming dark green or blackish tufts: leaves erect to spreading, oblong to ovate-lanceolate, 1 to 1.5 mm. long, obtuse to acute, concave, carinate, firm; costa strong, almost percurrent; cells small, thick-walled, rounded; the alar often quadrate-inflated and hyaline in the stem-leaves, the whole lower fourth of the perichætial leaves elongate-rectangular and hyaline: seta erect, about 2.5 mm. long, sinistrorse; capsule ovate-globose, smooth, about 1 mm. high; operculum low-conic, obliquely long-rostrate; peristome of 16 very short, wide, truncate, smooth, trabeculate teeth, often more or less confluent; annulus none; calyptra, at first conic, large, cucullate; spores minutely roughened, chlorophyllose, about .080–.095 mm., moderately incrassate, mature in summer.

On tree-trunks in woods, Japan, and in North America from New England to Alabama, Missouri, and Ontario.

Erie : Presque Isle, May 8-9, 1906. O. E. J. (Figured).

McKean : Quintuple, Bradford, November 10, 1893. D. A. B.

Washington : Linn and Simonton. (Porter's Catalogue).

3. *ORTHOTRICHUM* Hedwig.

Autoicous, rarely dioicous: cespitose in cushions sometimes on rocks, mostly on trees: stems erect and ascending, radiculose at the base, thickly leaved, branched; leaves when dry never crispate but straight and appressed, ovate-or linear-lanceolate, mostly acute, margins usually revolute; costa quite strong, mostly not quite percurrent; basal leaf-cells rectangular to elongate, pellucid to hyaline, the marginal often shorter and green: seta generally shorter than the scarcely or non-sheathing perichætial leaves; capsule oval to cylindric, usually with 8 or 16 colored striæ, when dry usually 8 (–16)-furrowed; annulus persistent; peristome mostly double, sometimes single, rarely none, usually with 16 broadly lanceolate teeth in pairs, and 8 to 16 filiform segments; operculum conic to convex, rostrate; calyptra campanulate, plicate, covering most of the urn, glabrous, hirsute or papillose.

A cosmopolitan genus of about 206 species, on trees or rocks, rare, however, in the Tropics; about 70 species occur in North America; at least 5 in our region.

Key to the Species.

a. Peristome simple, teeth 16, erect or erect-spreading when dry. b.

a. Peristome double, teeth more or less reflexed when dry. d.

b. Capsule half-emergent, 16-striate. (*O. cupulatum* [Hoffmann] Schwaegrichen.)

b. Capsule immersed to half-emergent, 8-striate. c.

c. Capsule ovate-cylindric, half-emergent when leaves are dry. 1. *O. strangulatum.*

c. Capsule much shorter, ovate-globose, practically immersed in the dry leaves. 2. *O. lescurii.*

d. Capsule smooth when dry, immersed. e.

d. Capsule plicate when dry. f.

e. Teeth 16, in pairs; segments 8, short, filiform. (*O. pusillum* Mitten.)

e. Teeth 16, not in pairs; segments 16, comparatively broad. (*O. leiocarpum* Bryologia Europæa.)

f. Leaves more or less obtuse at the extreme apex. g.

f. Leaves usually distinctly acute at the extreme apex. i.

g. Capsule strongly contracted below the mouth when dry and very decidedly plicate with reddish-brown folds. 3. *O. braunii.*

g. Not very strongly contracted nor very decidedly plicate. h.

h. Stomata immersed; leaf-margins revolute. 4. *O. ohioense.*

h. Stomata not immersed; leaf-margins erect; leaves short and broad, oblong-ovate. (*Orthotrichum obtusifolium* Schrader, Schwaegrichen.)

i. Capsule but little contracted below mouth when dry, ribs orange, segments 8; leaves oblong-lanceolate. 5. *O. schimperi.*

i. Capsule strongly contracted under the mouth when dry. j.

j. Capsule with very prominent reddish-brown ribs when dry, half-emergent. 3. *O. braunii.*

j. Capsule with less prominent light colored ribs, usually immersed. (*O. sordidum* Sullivant.)

1. **Orthotrichum strangulatum** Schwaegrichen.

(*O. porteri* Austin; *O. cupulatum* var. *porteri* Venturi).

(Plate XIV)

Densely cespitose, about 1 cm. high: stems densely leaved, branched; upper leaves lanceolate, about 3 mm. long, the lower ovate, shorter, acute, margins entire or papillose, more or less revolute, lamina often somewhat bi-stratose at margins and apex; costa strong, almost percurrent; basal leaf-cells quadrate at margin to rectangular (2:1) towards costa, smooth, hyaline, the median rounded-hexagonal, dense, papillose, becoming towards apex densely incrassate-rounded, arranged in quite regular rows: seta short, about 0.5 mm., capsule about 1.5 mm. long, oblong-cylindric, tapering rather gradually to the seta, when dry often only partly immersed, when wet always immersed, dark reddish-brown, deeply 8-costate and 8-furrowed, the costæ with about 3 rows of rectangular cells with thicker longitudinal walls, stomata few, immersed, calyptra mitrate, quite densely erect-hirsute; operculum low with a rounded apiculation; peristome single, teeth paired, erect-spreading when dry, irregularly triangular-lanceolate, about 8-articulate, the divisural distinct and the teeth often split; the three or four upper rows of cells of the capsule densely incrassate, brown, pellucid like the costal and laterally oblong; spores globose, papillose, .017–.020 mm., mature in summer.

On rocks, Pennsylvania, Ohio, and Minnesota.

Cambria: : Cresson. James (Porter's Catalogue).

Center : On limestone rocks, two miles west of Scotia, September 22, 1909. O. E. J. (Figured).

Westmoreland : Chestnut Ridge, above Hillside, on sandstone rocks, September 23, 1910. O. E. J. and G. K. J.

2. **Orthotrichum lescurii** Austin.
(*O. cupulatum* variety *minus* Sullivant).
(Plate XV)

Rather densely cespitose, about 5 mm. high: stems thickly-foliate, branched; leaves lanceolate or some of the lower ovate, the upper about 3 mm. long, the lower shorter, acute, the margins entire, revolute, strongly costate nearly to the apex; basal leaf-cells quadrate to elongate-rectangular, smooth, hyaline, above becoming rounded-hexagonal, sub-opaque, densely papillose, smaller and quite regularly hexagonal at the apex; seta very short, 0.5 mm., about one-half enclosed in the involucre; calyptra narrowly campanulate, plicate, hirsute with erect hairs; lid mamillate, rounded but flattened; capsule oblong-cylindric and rather suddenly tapering to the seta, about 1.3 mm. high and 0.5 mm. in thickness, when moist globose-oblong and 8-striate, when dry deeply 8-furrowed and sometimes contracted below the mouth; capsule always about the same length as the upper leaves, or sometimes slightly exserted when dry; peristome single, the teeth 8, short, equidistant but leaning towards each other in pairs, triangular-lanceolate, papillose, articulate, the divisural usually complete and not split, teeth when dry erect or incurved; spores mature in spring, .014–.017 mm.

On rocks, usually granite or trap; from New England to Ontario south to Missouri and Pennsylvania, and in the Rocky Mountains to British Columbia. Rare in our region.

Westmoreland: On sandstone rocks at mouth of Bear's Cave, on slope of Chestnut Ridge above Hillside, September 16, 1910. O. E. J. and G. K. J. (Figured).

3. **Orthotrichum braunii** Bryologiæ Europæ.
(*O. strangulatum* Sullivant).
(Plate XV)

Sparsely cespitose to scattered, less than 5 mm. high, dark green: stems sometimes creeping at base, erect-spreading, simple or branched; leaves spreading when moist, the upper somewhat clasping, when dry appressed, not crisped, concave, ovate to lance-ovate, the margins more or less revolute, apex acute, sometimes erose-denticulate and apiculate and sometimes hyaline; costa strong, sub-percurrent basal leaf-cells hyaline, smooth, at margin quadrate, about .016 mm. in diameter, toward the costa rectangular and reaching about .090×.016 mm., median cells papillose, opaque, rounded, about .020 mm. in diameter, the apical smaller, rounded and less papillose; capsule oblong-oval, about 1.2 mm. long tapering abruptly into a seta about one-third as long, 8-costate, when dry much con-

stricted below the mouth and very deeply 8-plicate, somewhat sinistrorse, reddish-brown; peristome-teeth lighter in color, granulose, with distinct divisurals, when dry closely reflexed, when moist erect; calyptra narrowly conic-mitrate, non-hirsute and plicate; spores globose, somewhat papillose, incrassate, about .017 mm. in diameter.

On bark of living trees, often apple-trees; Europe, Asia, northern Africa, and from Nova Scotia to Georgia and Iowa. Scarce in our region.

Allegheny : On base of *Quercus imbricaria* in mixed pine and oak woods at Dutil Church, near Douthett, December 29, 1908. O. E. J. (Figured).

McKean : Bradford. D. A. Burnett. (Porter's Catalogue).

4. **Orthotrichum ohioense** Sullivant.

(*O. canadense* Sullivant, not Bryologia Europæa).

(Plate XV)

Densely cespitose, yellowish green above, dark or brownish below: stems freely branching, about 6–10 mm. high; leaves lanceolate from an oblong base, about 1.5–3 mm. long, spreading to ascending, bluntly acute to rounded-obtuse, papillose with entire and revolute margins; costa strong, ending at a little below the apex; median leaf-cells quadrate to rectangular, moderately incrassate, towards the margins and upwards becoming smaller, more incrassate, quadrate, sub-papillose, the upper small, rounded, densely papillose, incrassate: seta shorter than the urn; capsule more or less completely immersed, ovate-oblong when moist to somewhat narrower and pyriform-campanulate when dry, symmetric, when dry 8-striate, pale yellow, tapering at base, slightly constricted below the mouth; exothecial cells at mouth in one to three rows, small, quadrate, below abruptly rounded and strongly incrassate, on the main body of the urn rectangular and much smaller; stomata immersed, the outer peristome of 8 double teeth, yellowish-pellucid, densely punctulate, triangular-lanceolate, 5–7-articulate; segments of inner peristome of 8 short, linear-subulate segments of two rows of cells; calyptra conic-campanulate, yellowish, plicate, densely erect-hairy; operculum low-convex, apiculate-rostrate; spores yellowish-brown, pellucid, densely papillose, .018–.020 mm., mature in spring,—about April: autoicous, antheridial clusters axillary.

On bark of trees, New Brunswick to Ontario and south to Georgia, also in Montana. Probably rather common in our region. Ashtabula, Ohio, and as follows:

Erie : On bark of *Populus deltoides,* Presque Isle, September 20-22, 1906. O. E. J.

McKean : Langmade, Bradford, May 8, 1898. D. A. B. (Figured).

4a. **Orthotrichum ohioense** variety **citrinum** (Austin) Lesquereux and James.

(*O. citrinum* Austin).

Leaves dark green, narrowly lanceolate; capsule thin, yellow.

On bark of trees and with about the same range as the species. Occurs in our region at Painesville, Ohio, and as follows:

Westmoreland : T. P. James. (Porter's Catalogue).

5. **Orthotrichum schimperi** Hammar.

Densely cespitose, dark green; stems only a few mm. high; leaves erect-spreading, lance-oblong, when dry imbricated and straight, obtuse to short-acuminate, margin recurved; upper leaf-cells rounded-hexagonal, rather thin-walled for the genus, relatively rather large, minutely papillose, the basal cells larger, rectangular and smooth; costa strong, ending a little below the apex: seta very short, capsule immersed, small, when moist oval-oblong with a distinct neck, when dry narrower, constricted below the mouth, 8-plicate, yellowish to orange; stomata immersed; exothecial cells quadrate to rectangular-hexagonal, becoming at the mouth much smaller, rounded, and rather obscure; peristome-teeth 8, bigeminate, yellowish-pellucid, triangular-lanceolate, papillose, when dry reflexed, the segments almost as long, lance-subulate, 8 in number; calyptra smooth, short, inflated, lustrous, with few or no hairs, light yellow; spores .012–.015 mm., mature in spring: autoicous.

On trunks of trees; Europe, Asia, Algeria, and, in North America, in Vermont, Pennsylvania, District of Columbia, Idaho, etc. Rare in our region.

Washington : Linn and Simonton. (Porter's Catalogue).

4. *ULOTA* Mohr.

Autoicous, rarely diocious: mostly forming cushions on living trees: stems often creeping with erect or ascending branches, radiculose; leaves crisped or contorted when dry, mostly spreading to squarrose, from a broadly concave base lance-linear, carinate, with margins mostly revolute below; costa percurrent or nearly so; basal cells narrowly linear, yellowish but with a margin of one to several rows of hyaline,

thin-walled, rectangular to quadrate cells: capsule erect, exserted, symmetric, 8-plicate when dry, stomata superficial; annulus persisting; peristome mostly double, segments usually 8, rarely 16 or none; lid convex or conic, rostrate; calyptra mitrate, with 10–16 obtuse folds, incised-lobed at base, hirsute with shining golden-yellow hairs or rarely almost glabrous.

A world-wide genus of about 50 species, most numerous in America; in North America 16 species; in our region three species.

Key to the Species.

a. Rupestral; leaves not crispate when dry. 1. *U. americana.*
a. Arboreal: leaves more or less crispate when dry. b.
b. Capsule smooth, slightly plicate below the distinctly narrowed mouth. 2. *U. ludwigii.*
b. Capsule wide-mouthed, distinctly plicate. c.
c. Capsule constricted below the mouth, gradually narrowed at base to the long neck: teeth confluent. 3. *U. crispa.*
c. Capsule not distinctly constricted below the mouth, abruptly narrowed to the shorter neck; teeth separated at apex. *3a. U. crispa* var. *minus.*

1. **Ulota americana** [Beauvois] Limpricht, not Mitten. (*U. hutchinsiae* Hammar).

(Plate XV)

Rather loosely cespitose, blackish with greenish tips, about 1 cm. high, or less: stems creeping, sparingly branched with erect branches, when dry the leaves appressed and straight; leaves often with hair-like paraphyllia at base, lance-ovate or linear-lanceolate from an ovate base, carinate, concave at least below, margins usually revolute in lower half, costa and base of lamina pellucid-castaneous, apex sub-acute; costa strong, sometimes percurrent; apical and median leaf-cells incrassate, papillose, rounded-quadrate, rather opaque, the basal marginal rounded-quadrate to rounded-rectangular, hyaline, towards the costa becoming linear, more or less vermicular and occasionally anastomosing, much incrassate and markedly pellucid-castaneous: seta about 2 mm. long, smooth, with a distinct smooth volva at base; capsule yellowish, cylindric-oblong, basally tapering, when dry 8-costate and with more or less distinct intermediate costæ at mouth, the neck and seta decidedly dextrorse; stomata immersed; peristome-teeth 16, more or less paired, articulate, granular, when dry strongly reflexed, segments 8, about one-half as high, biseriate below; calyptra yellowish, mitrate, plicate, incised-lobate at base, densely clothed with erect to spreading slender hairs; lid conic-rostrate; spores globose, papillose, incrassate, about .016–.018 mm., mature in spring.

On non-calcareous rocks, mainly in hilly or mountainous regions; Europe, Asia, and from New Brunswick to Georgia and west to the Rocky Mountains. Common in our region.

Cambria:	: Cresson. T. P. James. (Porter's Catalogue).
Center	: Dry rocks at top of Bald Eagle Mt., near Matternville, July 14, 1909. O. E. J.
Fayette	: On rocks in bed of Youghiogheny River at Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
Huntingdon	: T. C. Porter. (Porter's Catalogue).
McKean	: On rocks, Rutherford, May 13, 1898. D. A. B.
Somerset	: On dry, crumbling shale, Ursina, May 12, 1905. O. E. J. (Figured).

2. **Ulota ludwigii** (Bridel) Bridel.

(*Weissia coarctata* Lindberg)

(Plate XV)

Loosely cespitose, yellowish green: stems more or less creeping with erect shoots often 1 cm. high, usually shorter, somewhat branched below; leaves erect-spreading but slightly twisted when dry, lance-ovate to lanceolate, concave at base, often carinate-concave in upper third, acuminate above but the extreme apex rather obtuse, the margin entire and often recurved; costa strong, reddish, sub-percurrent; basal leaf-cells at margin quadrate, hyaline, towards the costa rectangular to linear-vermicular, reddish-pellucid, the median cells rounded-quadrate, incrassate, slightly papillose, the apical cells similar; capsule pyriform, tapering into a slender dextrorse seta, seta and capsule together about 3.5 mm. long, capsule strongly costate but with a very small mouth and, even when dry, smooth and plicate only immediately below the mouth, pale yellowish-brown, stomata superficial at the base of the urn; calyptra narrowly conic-mitrate, hairy; lid rostellate; peristome single, or rarely with rudimentary segments, teeth somewhat paired but split apart above, when dry erect, narrowly triangular, granulose, distinctly articulate, with a distinct divisural; spores papillose, globose, about .020–.022 mm. in diameter, mature in summer.

On tree-trunks in woods, usually in mountainous or hilly country; Europe, and in North America from the Gulf of St. Lawrence to Ontario and south to North Carolina. Rather uncommon in our region.

Center	: Bear Meadows. T. C. Porter. (Porter's Catalogue).

McKean : Rutherford, March 6, 1893. D. A. B. (Figured).
Washington : Linn and Simonton. (Porter's Catalogue).

3. **Ulota crispa** [Linnæus] Bridel.

(*Ulota ulophylla* Brotherus; *Orthotrichum crispum* Hedwig).

(Plate XVI)

Densely cespitose, yellowish-green above, darker below, the tufts about 8 mm. high: stems sparingly branched, growing perpendicular to the bark on which it is found, sometimes decumbent at base; leaves straight and erect-spreading when moist, when dry much crisped, narrowly lance-ovate to sharply acute to acuminate at the apex, concave and more or less carinate, often marginally revolute; marginal basal leaf-cells hyaline, the inner basal pellucid, linear, often somewhat vermicular, the median cells incrassate, rounded, bluntly papillose, the apical cells smaller and less papillose; costa strong, sub-percurrent; seta and capsule together about 4 mm. long, capsule ovate-globose when wet, about 1 mm. long, tapering rather gradually into the neck and seta, when dry somewhat constricted below the mouth, with the neck and seta dextrorse, the costa brownish-pellucid; annulus brown, pellucid, of about 3 series of small, close-set, rounded, cells; teeth triangular-lanceolate, united into 8 pairs, when dry reflexed, each pair confluent and cribrose at apex, often split along the divisural below; segments 8, consisting of two rows of cells nearly up to the apex, a little shorter than the teeth; spores globose, about .023–.026 mm., mature in summer.

On trees in woods; Europe, Asia, Tasmania, Alaska, and from Newfoundland to Georgia. Fairly common in our region.

Allegheny : On trunk of Black Oak, Keown, November 14, 1909. O. E. J.
Center : On black oaks, Bald Eagle Ridge, near Matternville, September 21, 1909. O. E. J. (Figured).
Crawford : Pymatuning Swamp, Linesville, June 12, 1906. O. E. J.
McKean : Langmade, Bradford, May 29, 1898. D. A. B.

3*a*. **Ulota crispa** variety **minus** (Schwaegrichen) New Combination.

(*U. crispula* Bruch).

With shorter stems and leaves than in the species and a capsule which rather abruptly narrows into a long neck, and with a sub-globose to oval urn, which, when dry and empty,

is more or less open-mouthed and turbinate, with little or no constriction below the mouth.

This variety is reported with a general range similar to that of the species but we have as yet seen no typical specimens of it from our region. Porter's Catalogue lists it from several counties in Eastern Pennsylvania and from McKean County, D. A. Burnett; but a specimen in the Herbarium of the Carnegie Museum collected by Burnett, at Langmade, May 29, 1898, McKean County, is evidently purely *U. ulophylla*.

Famiy IX. *SPLACHNACEAE*.

Autoicous or dioicous, rarely pseudautoicous: annual or perennial cespitose bog or alpine mosses, usually living on decaying animal or vegetable matter, the tufts green to yellow-green, inside more or less red-radiculose, sometimes blackish: stem delicate with a large central strand; leaves mostly distant, flaccid, more or less broad; costa mostly not quite percurrent, usually with two basal guides; leaf-cells loose, parenchymatous, 4–6-sided, elongate towards the base, sparingly chlorophyllose, often inflated at the margin of the leaf: seta erect, sometimes very long; capsule erect, symmetric, with a long collum or with a large colored hypophysis: usually annulus none; peristome simple, teeth sixteen, flat, aggregated in pairs or in fours, more or less hygroscopic, vertically striate, trabeculate, punctate, mostly golden-brown; spore-sack surrounded by a cavity; columella strong; spores small to large; operculum convex to umbonate or long-conic, rarely none; calyptra small, either cucullate and united into a tube below or conic and almost entire to lobed.

A small family of 5 genera and about 60 species; in our range but one genus.

1. *SPLACHNUM* Linnæus, Hedwig.

Autoicous, or, when old, dioicous: weak, distantly leaved; male flowers terminal, bracts stellate-squarrose; bog-mosses growing mainly upon the excrement of cattle or, as in Canada and northern United States, often upon that of the moose: tufts loose, soft, shining, light to yellowish-green; leaves flaccid, spreading, when old wine-red at the base, broadly obovate, plane, acute, entire except sometimes at the very apex; costa weak, ending below the apex; areolation very lax: seta long, slender, dextrorse; capsule erect, small, oval to cylindric, surmounting a much wider inflated hypophysis which may be obovate, globose, or parasol-like, mostly dark violet-purple, when dry much wrinkled; annulus none; teeth confluent at base, paired, very hygroscopic; spores small; operculum swollen or umbonate, fugacious; columella capped, generally

exserted after the operculum has fallen; calyptra small, conic, often split down one side.

A genus of 9 species, mostly of the northern hemisphere; 7 in North America; one species in our range.

1. **Splachnum ampullaceum** Linnæus, Hedwig.

Loosely cespitose: stems 1–2 cm. high; leaves distant, the lower lanceolate, the upper long obovate-lanceolate with a long tapering acumen, coarsely serrate above, soft, light green; costa ending in or just below the apex; leaf-cells large, more or less regularly hexagonal: seta 2–5 cm. long, reddish-brown, erect; capsule oblong-cylindric, yellowish, surmounting a much larger, broadly pyriform, soft and fleshy hypohysis, usually reddish-brown above and "pale lilac below," rugose when dry; lid convex, obtusely mamillate; peristome-teeth 16, in pairs, yellowish, strongly reflexed when dry; spores mature in summer: usually autoicous; antheridial flowers terminal, discoid.

On organic matter in swampy places, usually on excrement of larger herbivorous animals. Europe, Asia, and, in North America, from Newfoundland to Ontario south to New Jersey, Pennsylvania, and Ohio. To be looked for in the northern and northwestern part of our region.

Family X. *DISCELIACEAE.*

Dioicous; gregarious, annual, with persistent protonema: stem very short with gemmiform foliation; inner leaves largest, ovate to lance-oblong, acute, with plane margins, entire; costa none; cells loosely rhomboid-hexagonal, thin-walled, pellucid, elongated below, smooth, very sparsely chlorophyllose: seta elongate, 2–3 cm., stiff, slender, pellucid, red or castaneous, decidedly sinistrorsely twisted; capsule minute, cernuous or horizontal, globose-ovate, smooth, with a short collum; annulus of one (or two) series of cells, falling away in pieces; peristome inserted below the mouth, simple; teeth lanceolate, acute, red, the lower half usually perforate or split, the exterior usually vertically striate but with no median line, not papillose, the interior with papillæ and projecting trabeculæ; spores medium size; operculum large, convex, unbonate; calyptra split down on one side and usually remaining attached to the seta by the constricted base.

A peculiar family consisting of but one genus with only the following species. Occurring in sandy soil in northern Europe, Asia, and, in North America, in Illinois, Ohio, and Eastern Pennsylvania.

1. *DISCELIUM* Bridel.

1. **Discelium incarnata** (Schwaegrichen) New Combination. (*D. nudum* Bridel; *Weisia incarnata* Schwaegrichen).

Characters as for the family.

The Ohio station for this species is only a few miles from the northwestern corner of Pennsylvania and the species may eventually be discovered in our region.

Family XI. *EPHEMERACEAE.*

Autoicous or dioicous, rarely polyoicous or synoicous: minute, about 1–2 mm. high, singly disposed or gregarious, mostly stemless; protonema sometimes persistent; leaves minute, linear to lanceolate or ovate to obovate, often tufted, rosette-like, spreading or erect-spreading; leaf-cells mostly lax, more or less elongate below, rectangular to rhomboid-hexagonal, above shorter, usually smooth; costa none to excurrent, usually present: seta none or short; capsule immersed, subglobose, cleistocarpous; operculum sometimes differentiated but rarely deciduous of itself; spores mostly large and papillose; calyptra mostly small, delicate, mitrate-campanulate.

Minute plants growing on soil.

Key to the Genera.

a. Leaves lanceolate; green protonema persistent. 1. *Ephemerum**

a. Leaves ovate; green protonema not persistent. b.

b. Stem none. 2. *Acaulon.*

b. Stem evident. 3. *Physcomitrella.*

1. *EPHEMERUM* Hampe.

Dioicous, rarely polyoicous: minute plants with abundant and persistent green protonema: upper leaves elongate-lanceolate to linear; costa none or variously developed; leaf-cells lax, mostly thin-walled, rhomboidal: seta rudimentary or none; capsule mostly globose and apiculate, cleistocarpous, walls of one layer of cells with stomata; spores large, up to .08 mm. in diameter, warty; calyptra campanulate, delicate, torn at the base or sometimes only on one side.

A cosmopolitan genus of about 25 species; 8 or 9 species occurring in North America, perhaps most of these occurring in our region, but on account of their minute size not yet collected.

Key to the Species.

a. Costa none. b.

a. Costa more or less complete, or vanishing towards the base. c.

b. Leaves lanceolate, erect-patent, spores .060—.080 mm. (*E. serratum* [Schreber] Hampe.)

**Nanomitrium* Lindberg (*Micromitrium* Austin) differs from *Ephemerum* in having a rudimentary but not deciduous operculum and the capsule without stomata and with a wall but one cell thick.

b. Leaves linear-lanceolate, often secund: spores smaller. (*E. serratum angustatum* Bryologia Europæa.)

c. Costa percurrent or vanishing near the apex. d.

c. Costa excurrent and quite strong. g.

d. Upper leaves broadly lanceolate to elongate-lanceolate. e.

d. Upper leaves narrowly linear-lanceolate, long-acuminate. f.

e. Capsule short, obtuse; costa effaced at base, upwards towards the apex continuous. 1. *E. cohaerans.*

e. Capsule acutely beaked: costa loosely areolate, scarcely distinct except towards the short, entire, pointed apex. (*E. pallidum* Schimper.)

f. Calyptra smooth: leaves gradually long-acuminate, slightly and irregularly serrate at apex. 2. *E. crassinervium.*

f. Calyptra papillose: leaves papillose on both sides. (*E. papillosum* Austin.)

g. Leaves with almost entire margin or shortly serrate above. (*E. stenophyllum* [Bridel] Schimper.)

g. Leaves with a long, hyaline, spinulose arista. (*E. spinulosum* Schimper.)

1. **Ephemerum cohaerans** (Hedwig) Hampe.

(*Phascum cohaerans* Hedwig).

Plants minute, 1–1.5 mm. high, densely gregarious or somewhat cespitose: protonema persistent, green or yellowish with age; leaves lance-ovate to lance-oblong, erect-spreading, acute, serrate above; costa thin, stronger above, ending in the apex or just below; leaf-cells lax, oblong-hexagonal, rather thin-walled: capsule sub-sessile, castaneous, subglobose, obtusely apiculate, bearing stomata all over; calyptra more or less lobed or torn at base: spores large, .060–.080 mm., coarsely tuberculate, mature in late autumn: dioicous.

On moist sandy or clayey soil, Europe and, in eastern North America, south to Louisiana. Not yet collected in our region but occurring in Eastern Pennsylvania and in Ohio.

2. **Ephemerum crassinervium** (Schwaegrichen) C. Mueller, not Hampe.

(*Phascum crassinervium* Schwaegrichen).

Plants minute, not over 1 mm. high, gregarious: green protonema persistent; leaves erect-spreading, flexuous, linear-lanceolate, slenderly long-acuminate, rather coarsely serrate above, marginally plane; costa flat, faint below, stronger above, percurrent, denticulate dorsally above; leaf-cells more or less rectangular to oblong-hexagonal, thin-walled: capsule with a very short seta, immersed, globose, apiculate; the capsule about half-covered by the cleft-lobate, mitrate-conic calyptra;

spores large, papillose, mature in late autumn to early spring.

On moist earth, often in swamps, eastern North America. Occurs in Central Ohio and Eastern Pennsylvania and is, probably, the plant referred to as follows:

Indiana : James. (Porter's Catalogue).

2. *ACAULON* C. Mueller.

(*Sphaerangium* Schimper).

Dioicous: minute, bud-like, brown, gregarious: stem very short and few-leaved, without central strand, unbranched, green protonema persistent; leaves erect-spreading, broadly ovate, keeled or concave, above with revolute and sinuate-denticulate margin, or plane and entire; costa more or less excurrent-cuspidate; upper cells short-rhombic, below rhomboidal, dorsally strong thickened, smooth, rarely with a few high papillæ, the lowest thin-walled, hyaline and rectangular: seta very short; capsule sub-globose, cleistocarpous, immersed; calyptra very small and delicate, conic-mitriform 3–5-cleft; spores small, brown, subglobose, minutely granulose.

A widely distributed genus, on soil, mostly in the temperate zone. Fifteen species in all, 4 in North America, 2 in our region.

Key to the Species.

a. Uppermost and perichætial leaves sharply carinate and with reflexed margins. 1. *A. triquetrum.*

a. Uppermost and perichætial leaves concave; and with margins plane. 2. *A. rufescens.*

1. **Acaulon triquetrum** (Spruce) C. Mueller.

(*Sphaerangium triquetrum* Schimper).

Plants minute, about 1 mm. high, bulbiform, pale green or yellowish, distinctly triquetrous; protonema green, persistent; lower leaves small, rounded, the middle leaves larger, broadly ovate, deeply concave, convolute, the upper largest (perichætial) broadly ovate, deeply carinate, triquetrous, all upper leaves with reflexed margins, erose-denticulate above; costa strong, in upper leaves excurrent in a recurved apiculus; basal leaf-cells elongate-hexagonal, lax, thin-walled, hexagonal to oblong-hexagonal: seta about as long as capsule, arcuate; capsule globose, smooth; calyptra minute, mitrate, cleft-lobed, covering only very apex of capsule; spores papillose, about .025–.030 mm., mature in early spring.

On clayey or sandy soil in fields or on banks, Europe, Algeria, and, in North America, from western Canada to New England south to the Carolinas; occurs in Ohio and in Pennsylvania but not yet reported from our range.

2. **Acaulon rufescens** Jaeger.

(*Phascum rufescens* Kindb.)

Plants minute, bulbiform, about 1 mm. high, yellowish-green, not markedly triquetrous: protonema persistent; lower leaves very small, ecostate, the upper much larger, broadly ovate, deeply concave, convolute, plane-margined, erose-denticulate at apex; in larger leaves the costa thick, excurrent into a squarrose-recurved apiculus; leaf-cells about as in *A. triquetrum*: seta flexuose or arcuate; capsule globose, smooth; calyptra and spores similar to those of *A. triquetrum*.

On bare clayey or sandy soil in moist fields, Eastern and Central North America.

Indiana : Derry. James. (Porter's Catalogue, as *Sphaerangium muticum* [Schreber] Schimper).

3. *PHYSCOMITRELLA* Bryologia Europæa.

Paroicous, rarely synoiccus: protonema sparse and disappearing early: minute, gregarious, somewhat succulent: stem mostly low, simple, without central strand; upper leaves rosette-like, spreading, obovate, acute to acuminate, plane-margined, bluntly serrate; costa ending below the apex; leaf-cells very lax, rhomboid above, the lower rectangular and sparsely chlorophyllose: seta rudimentary; capsule subglobose, without collum, apiculate; operculum hardly distinct but capsule usually splitting equatorially; cells of capsule-wall large, hexagonal, thin-walled; the large columella eventually completely absorbed; spores large, papillose; calyptra narrowly campanulate.

A genus of but 2 species: *P. hampei* Limpricht, in Europe, and the following:

1. **Physcomitrella patens** [Hedwig] Bryologea Europæa.

(*Phascum patens* Hedwig).

Gregarious, pale green: stem distinct but very short, about 2 mm.; leaves lance-ovate to oblong or oval, usually shortly and bluntly acuminate, the upper often obovate-acuminate and larger, forming a rosette, all serrate above; costa narrow, ending below the apex; leaf-cells lax, widely rectangular to hexagonal: seta short, capsule globose, thin-walled, usually splitting equatorially, brownish, immersed to slightly emergent, obtusely apiculate; spores papillose, .025–.030 mm., mature in autumn: paroicous; antheridia sessile in upper leaf-axils.

On wet clayey or sandy soil in fields, along sides of pools, river banks, etc. Europe, Asia, and, in North America, not uncommon in Ohio and also reported from Lancaster County, Pennsylvania. Not yet reported from our region.

Family XII. *FUNARIACEAE.*

Autoicous or paroicous, rarely dioicous or synoicous: annual or rarely biennial, low, mostly light green, gregarious or loosely cespitose: stem mostly with a central strand, radiculose only at the base; leaves soft, wide, the upper larger and forming a rosette, concave, margin plane to involute, entire or denticulate upwards, sometimes bordered; costa delicate, rarely excurrent, with two large basal guides, rarely lacking; leaf-cells large, parenchymatous, thin-walled, never papillose, but slightly chlorophyllose, oblong-rectangular below, rhombic-hexagonal above: seta mostly erect and red, twisted; capsule either erect, symmetric and globose to pyriform, or cernuous and arcuate-pyriform; collum mostly distinct; annulus rarely present; peristome inserted back of the periphery to the distance of the thickness of several cells, simple or double, rudimentary or none; teeth 16, obliquely dextrorse, strongly trabeculate; segments 16, opposite the teeth, with no basal membrane; columella mostly thick; spores mostly medium-sized; operculum mostly weakly convex, sometimes umbonate or none; calyptra various, often inflated, usually rostrate and cucullate.

Key to the Genera.

a. Capsule immersed. b.
a. Capsule exserted. c.
b. Cells of capsule-wall with thickened angles (collenchymatous) capsule dehiscing equatorially, with no modified cells at the line of splitting. 1. *Aphanorhegma.*
b. Cells of capsule-wall not collenchymatous; capsule operculate and with one to three rows of thickened cells around the mouth. 2. *Physcomitrium.*
c. Capsules symmetric, erect, gymnostomous. 2. *Physcomitrium.*
c. Capsules unsymmetric, peristomate, usually with a double peristome. 3. *Funaria.*

1. *APHANORHEGMA* Sullivant.

Paroicous, rarely synoicous: low, gregarious to almost cespitose, pale green; stem radiculose at base, loosely foliate below, densely foliate above; leaves spreading or the upper almost erect, obovate to oblong or spatulate-lanceolate, acute, serrate in the upper half; costa ending below the apex; leaf-cells lax, the basal rectangular, the upper oblong-hexagonal, the marginal forming a narrow uniseriate border: seta rudimentary; capsule spherical, without a collum, laxly areolate, the cells at the mouth collenchymatous; annulus none; peristome none; spores large, densely spinulose; operculum half-spherical, of same size as urn, obtusely apiculate; calyptra conic-mitrate, lobed, glabrous.

A genus of two species, on damp soil. One in Cuba and the following one in temperate North America:

1. **Aphanorhegma serratum** (Hooker, f. and Wilson) Sullivant.

(Plate XVI)

Gregarious, light green: stems erect, simple or forking, 1–5 mm. high, radiculose at base; leaves small and lance-oblong below, rapidly becoming larger up to 3–5 mm. long, narrowly lance-obovate above, the lower widely spreading and flexuous, the inner erect-spreading, thin, slightly serrate above the middle, apex acute to acuminate: costa medium, ending in or just below the apex; the median basal cells thin-walled and more or less inflated, rectangular, the marginal narrower, a few quadrate at the base, becoming linear-rectangular above the base, in the upper part of the leaf their tips extending as low serrations, the median rhomboid to short rectangular with walls medium, the apical longer and narrower: seta very short and stout; capsule brown when ripe, globose to depressed-globose, about 0.75 mm. in diameter, smooth to apically papillose, splitting in the middle along a line of one or two rows of small more or less orange-pellucid cells, the upper half of the capsule (operculum) apiculate-rostrate; exothecial cells of capsule quadrate, conspicuously collenchymatous; calyptra hyaline, conic-mitriform, 4–6-lobed, covering the upper half of the operculum; spores globose, about .030 mm. in diameter, orange-pellucid or even darker, mature in autumn.

On damp clayey soil in the northern and middle United States, in our region usually along streams where submerged during periods of high water.

Allegheny : Stream banks, Fern Hollow, Pittsburgh, August 20, 1906; Guyasuta Hollow, November 9, 1908, and Thornhill, December 29, 1908. O. E. J.

Fayette : Cheat Haven, September 6, 1910. O. E. J. and G. K. J. (Figured).

2. *PHYSCOMITRIUM* (Bridel) Fuernrohr.

Autoicous: mostly minute, densely gregarious to cespitose, green, mud-inhabiting mosses: stem erect, simple, radiculose below, loosely foliate; leaves flaccid, mostly appressed when dry, spreading when moist, concave, obovate to oblanceolate or spatulate, mostly not margined, more or less serrate, obtuse to acuminate; costa mostly strong, incomplete to excurrent; areolation lax: seta mostly long; capsule erect, symmetric, globose to short-pyriform, with lax areolation; collum short and thick; annulus small-celled and persistent or large-celled and disappearing in pieces; gymnostomous; spores large, papillose; operculum broad, conic-convex, umbonate or

apiculate; calyptra long and erect-rostrate, mitrate, lobed to the base of the beak, covering one-half or less of the capsule.

A cosmopolitan genus of about 75 species; 17 species in North America, at least 2 species in our range.

Key to the Species.

a. Seta very short; capsule immersed, wide-mouthed; calyptra small. 1. *P. immersum.*

a. Seta longer; capsule exserted, not wide-mouthed; calyptra larger. 2. *P. turbinatum.*

1. **Physcomitrium immersum** Sullivant.

(*Gymnostomum immersum* Sullivant).

(Plate XVI)

Plants small, erect, gregarious, light green, simple or branching, 3–8 mm. high; leaves 1.5–3.5 mm. long, obovate to oblanceolate, serrate above the middle, spreading to ascending; costa strong, ending a little below the apex; leaf-cells parenchymatous, rather large and thin-walled, the basal rectangular, about 2–5:1, the upper irregularly oblong, the marginal narrower and in the alar region a few much shorter: capsule immersed, globose to pyriform-globose, 0.6–0.9 mm. in diameter, apiculate-rostrate, about the upper two-fifths constituting the operculum, yellow-brown when ripe; seta considerably shorter than capsule and stout; exothecial cells irregularly quadrate to hexagonal, somewhat incrassate, the annulus consisting of one to three rows of much smaller, orange-pellucid, to brown-pellucid cells, the cells of the wall usually laterally elongated for one or two rows above and below the annulus; calyptra mitrate, the basal margin 4–5-lobed, covering about one-half of the operculum; spores densely papillose, orange to brownish-pellucid, globose, in our specimens about .035 mm. in diameter, mature in autumn.

Usually on clayey or sandy flood-plains where submerged in time of freshets. Quebec to Colorado and Delaware but not commonly collected, probably on account of its small size and special habitat.

Beaver : Clay bank of Little Beaver Creek, New Galilee, September 10, 1906. O. E. J.; bank of Ohio River, Smith's Ferry, October 1, 1910. O. E. J. (Figured).

McKean : East Branch, Bradford, June 15, 1895. D. A. B.

2. **Physcomitrium turbinatum** (Richardson) C. Mueller.

(*Phascum strangulatum* Kindberg; *Phascum hookeri* Macoun).

(Plate XVI)

Gregarious, often densely so, light green: stems 3–5 mm. high, erect, usually simple; leaves 3–5 mm. long, lance-ob-

long to obovate-lanceolate, slightly serrulate above the middle, flat and spreading when moist, somewhat crisped and incurved when dry; capsule erect, 1.5–2 mm. high, globose to pyriform, when dry becoming turbinate and constricted below the mouth and at the base, finally becoming brown and urn-shaped; exothecial cells slightly incrassate, rhomboid to hexagonal, the mouth bordered by about 9–12 rows of laterally somewhat elongated cells and a narrow fringe of orange-pellucid and much smaller cells in 1–3 rows; operculum convex, bluntly mamillate to sub-rostrate; calyptra somewhat oblique, rostrate, unequally split at base into 3–5 lobes; spores decidedly papillose, orange-pellucid, in our specimens measuring about .026–.040 mm., mature in May and June, occasionally later: autoicous.

Common on bare earth in fields, along roadsides, etc., from Quebec to Florida and west to the Rocky Mountains, and also in California.

Allegheny	: Power's Run, April 28, 1907, and Thornhill, May 17, 1906. O. E. J. and G. K. J.; Pittsburgh, April 28, 1907. G. K. J.; Kennywood, May 3, and Carnot, May 18, 1902. J. A. S.; Aspinwall, April 9, 1905, Schenley Park, May 16, 1907, Power's Run, May 21, 1905, and Douthett, June 5, 1909. O. E. J. (Figured).
Beaver	: Beaver Falls, May 14, 1907. O. E. J.
Crawford	: Linesville, May 10-11, 1906. O. E. J.
Lawrence	: New Castle, 1906. Miss Susan Gageby.
McKean	: Gates Hollow, April 29, and Quintuple, June 13, 1898. D. A. B.
Somerset	: Ursina, May 12, 1905. O. E. J.

3. *FUNARIA* Schreber, Hedwig.

Autoicous: the antheridial inflorescences discoid, terminal, the archegonial on innovations: gregarious to cespitose: stem usually simple, radiculose at base; lower leaves distant, small, the upper becoming much larger, those at the apex more or less upright and tufted or gemmiform, entire or serrate, more or less acute; costa incomplete to excurrent; areolation lax, elongate-rectangular to rhombic, at the margin sometimes longer and narrower, forming a border: seta elongated, erect or cygneous at fruiting time, later erect and twisted; capsule with a thick collum or elongate-pyriform, symmetric to oblique, arcuate, with a narrow mouth, smooth to plicate, erect to cernuous; annulus large-celled, revoluble or none; peristome deeply inserted, double or simple, sometimes none; teeth lance-subulate, reddish to brownish-red, obliquely ascending to the right; segments as long or shorter, yellow, with basal mem-

brane, papillose, opposite the teeth; spores medium; operculum flat or convex; calyptra long-persistent, inflated-cucullate, long-rostrate, smooth, entire.

A cosmopolitan genus of about 190 species (including *Entosthodon*), on soil; 21 species in North America, 3 in our range.

Key to the Species.

a. Capsule neither striate nor plicate; no annulus.
1. *F. americana.*

a Capsule striate and more or less plicate; annulus curling off.
b.

b. Leaves long acuminate; costa very often excurrent.
2. *F. flavicans.*

b. Leaves short acuminate; costa mostly percurrent.
3. *F. hygrometrica.*

1. **Funaria americana** Lindberg.

(*F. muhlenbergii* Hedwig,—mainly plate, not description,—Lindberg.)

Small, gregarious to loosely cespitose: stems very short; leaves erect-spreading, ovate-oblong, long-acuminate, somewhat concave, plane-margined, entire; costa strong, excurrent, leaf-cells lax, moderately thin-walled, the basal quadrate-hexagonal to rectangular, the upper elongate rectangular: seta slender, rather short, up to 1.5 cm. long, when dry dextrorse below, sinistrorse above; capsule erect, subcernuous, pyriform-oblong, the mouth tilted to one side, when dry the long tapering neck rugulose, the urn smoothish and constricted below mouth; no annulus; peristome-teeth lance-linear, dextrorsely tilted, castaneous-pellucid, papillose, articulate, with divisural, strongly trabeculate; segments about as long and opposite teeth, pale pellucid; lid conic, obtuse, calyptra inflated, long-rostrate, cucullate; spores papillose, mature in May: autoicous.

On bare ground, Eastern Pennsylvania to Ohio and Minnesota, south to Georgia, and in the Rocky Mountains and California, but not often collected,—perhaps to be expected in our region.

2. **Funaria flavicans** Richardson, Michaux.

Loosely cespitose: stems erect, smaller than *F. hygrometrica;* lower leaves small, the upper leaves larger and tufted, oblong-spatulate to obovate, concave, plane-margined, entire, at apex long-acuminate; costa percurrent or excurrent; leaf-cells large, lax; seta long, erect, capsule oval-pyriform to globose-pyriform, more or less horizontal or downward curved, dark reddish when mature, with mouth less oblique and smaller than in *F. hygrometrica,* gradually attenuate below into the seta, not much furrowed

when old; lid low-convex, not apiculate; spores about .025 mm. in diameter, mature in May or June: autoicous.

On bare moist earth, usually clay, Abyssinia and, in North America, from New York south and west.

Lawrence : T. P. James. (Porter's Catalogue).

3. **Funaria hygrometrica** [L.—Sibthorp] Hedwig.

(Plate XVII)

Loosely cespitose, rather light green: stems about 3–10 mm. high, erect, radiculose at base, simple or basally divided; leaves erect to appressed, concave, forming a bulbiform tuft, oblong-ovate, acute or shortly acuminate, entire or slightly crenate, larger leaves 2–4 mm. long by three-fifths as wide, strongly costate to the apex or percurrently costate; cells rectangular to hexagonal, narrower towards margin, above more or less quadrate-hexagonal, the lower more or less inflated, above becoming more or less incrassate: seta about 2–5 cm. high, erect, sinistrorse, flexuous, lustrous, chestnut-brown, paler above; capsule unsymmetric, arched and turgid on upper side, 2–3 mm. long, strongly incurved at mouth, deeply sulcate when dry, pyriform, yellowish to brown when old, usually more or less horizontal but the upper part of seta often variously bent and curved and strongly hygroscopic; mouth about 0.6–0.8 mm. wide, annulus revoluble, deep castaneous; operculum low-convex; peristome-teeth castaneous-pellucid, papillose, strongly trabeculate, spirally twisted, united at apex; segments about three-fourths as long, papillose; spores smooth, round, about .014–.017 mm.; mature in May or June; calyptra cucullate, long-rostrate, early deciduous: autoicous.

Widely distributed over the earth; throughout North America. Common in our region on earth, burnt-over spots, etc. (Quite variable in size and leaf-characters but we have not been able to recognize any of the several described varieties in our region.)

Allegheny : Power's Run, April 22, and May 23, 1905, April 18, 1906. Schenley Park, Pittsburgh, August 16, 1905; Sandy Creek, May 8, 1904; Carnot, May 20, 1907, and October 11, 1908; Fern Hollow, August 20, 1906; Allegheny, May 26, 1909; Library P. O., April 29, 1906, all O. E. J.; Bakerstown Station, August 22, 1907. O. E. J. and G. K. J.

Beaver : Beaver Falls, May 14, 1907. O. E. J.

Cambria : : St. Lawrence, July 24, 1908. O. E. J.

Crawford : Linesville, May 10, 1906, and May 12 and May 28, 1908. O. E. J.

Fayette	: Ohio Pyle, June 14, 1908. O. E. J. and September 1-3, 1906, and Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
Greene	: Waynesburg, May 30, 1904. O. E. J.
Huntingdon	: Birmingham, May 17, 1904. O. E. J.
Lawrence	: New Castle, April 28, 1907. Miss Susan Gageby.
Mercer	: Houston Junction, July 12, 1902. J. A. S.
Somerset	: Ursina, May 12, 1905. O. E. J.
Washington	: Finleyville, July 2, 1904. G. E. K.; Charleroi, April 24, 1908. O. E. J.
Westmoreland	: Ligonier to Donegal, June 23, 1904. O. E. J. (Figured); New Florence, September 8-11, 1907. O. E. J.; Saunders Station, June 21, 1907. O. E. J. and G. K. J.

Family XIII. *SCHISTOSTEGACEAE.*

This family consists of one genus only, the characters being as follows:

1. *SCHISTOSTEGA.* Mohr.

Dioicous: inflorescences gemmiform, terminal, paraphyses none: minute and slender mosses in holes in earth, in caves, etc.: annual, gregarious on an abundant persistent protonema, which is more or less luminous by reflected light; sterile stems from the middle upwards with distichous, basally confluent leaves; fertile stems with a terminal 5-seriate tuft of leaves; leaves unistratose, ecostate; cells prosenchymatous, lax-rhombic, sparsely chlorophyllose: seta thin, erect, almost hyaline; capsule minute, erect, symmetric, globose, without stomata, annulus, or peristome; operculum small, convex; calyptra very small and fugacious, mitrate, covering only the operculum, smooth and naked; propagation often by brood-bodies on the protonema.

One species only, in crevices and caves in non-calcareous districts, in Europe, and, in North America, in New York and Ontario, Rocky Mountains, British Columbia, Thompson's Ledges, Ohio, and White Mountains.

1. **Schistostega pennata** [Hedwig] Hooker and Taylor.
(*Gymnostomum pennatum* Hedwig, *Schistostega osmundacea* Mohr.)

With characters as given for the genus.

Family XIV. *BRYACEAE.*

Dioicous, autoicous, paroicous, or synoicous, sometimes heteroicous: antheridial inflorescences with paraphyses;

cespitose, persistent, mostly on soil or rocks, sometimes on trees or rotting wood; stem usually rounded-pentagonal, with central strand, radiculose at least at base; leaves in several series, below mostly small and remote, above larger and often tufted, often bordered: costa mostly with 2–5 median guides, often excurrent; cells never papillose, upper prosenchymatous, mostly rhomboidal or rhombic-hexagonal, rarely linear or vermicular, basal rectangular to quadrate: seta elongate, erect, smooth, more or less curved; capsule cernuous to pendulous, sometimes erect, mostly symmetric, rarely arcuate, neither striate nor plicate, ovate or pyriform, rarely almost globose; collum evident, usually wrinkling when dry; annulus usually present, large-celled, spirally deciduous; peristome rarely none, or simple, mostly double, the 16 teeth often bordered, hygroscopic, papillose on the exterior, especially towards the apex, divisural line evident, trabeculæ prominent; segments alternating with teeth, delicate, yellowish or hyaline, often with cilia, often united below into a basal membrane; spores small to medium; operculum conic to convex, umbonate to apiculate or rarely short-rostrate; calyptra cucullate, small, fugacious.

A large and cosmopolitan family of about 15 genera and 1,000 species.

Key to the Genera.

a. Leaf-cells narrow, upwards narrowly rhombic to linear. b.

a. Leaf-cells lax, upwards rhombic to hexagonal, never linear. c.

b. Leaves long-subulate; cilia prominently appendiculate. 1. *Leptobryum.*

b. Leaves linear-lanceolate; cilia non-appendiculate, often rudimentary or none. 2. *Webera.*

c. Annulus mostly none; leaves non-bordered. 3. *Mniobryum.*

c. Annulus present; leaves often bordered. d.

d. Sporogonia single; stem without rhizome-like stolons. 4. *Bryum.*

d. Sporogonia often several together; stems erect from rhizome-like stolons. 5. *Rhodobryum.*

1. *LEPTOBRYUM* (Schimper) Wilson.

Synoicous or dioicous; paraphyses of the antheridial inflorescence with an acuminate end-cell; no paraphyses in the archegonial inflorescence: weak, cespitose in low, soft, lax, yellowish-green tufts; stem erect, thin, brown-radiculose at base; lower leaves remote, small, lanceolate, uppermost leaves much larger, tufted, erect to spreading, elongate-subulate from a lanceolate base, canaliculate and often distinctly toothed towards the apex; costa broad, flat, incomplete or percurrently filling the apex; cells very narrow and long, in the subulation linear, the basal rectangular-elongate: seta short to long, very

thin, tortuous, twisted when dry; capsule cernuous to almost pendent, with a thin, long, somewhat arcuate, pyriform collum, lustrous, narrow-mouthed; annulus narrow, deciduous; peristome-teeth pale yellow, the upper part subulate and bordered; segments about as long, fenestrate, the lower third forming a basal membrane, the cilia mostly long-appendiculate; spores of medium size; operculum small, convex, and mostly umbonate.

A genus of three species; one in Tasmania, one in Ecuador, and the following, almost a cosmopolitan:

1. **Leptobryum pyriforme** [Linnæus] Wilson.

(*Webera piriformis* Hedwig).

(Plate XVII)

Densely cespitose in light yellowish-green, soft, lustrous tufts: stems .5–1.5 cm. high, slender, erect, reddish, brown-radiculose at base; leaves mostly erect-spreading, flexuous, the upper forming a comal tuft, linear-setaceous, up to 4-5 mm., long, the basal portion lanceolate, the upper portion flexuous, with plane margin, denticulate above; costa strong but rather wide and indistinct, occupying most of the upper portion of the leaf and somewhat excurrent; leaf-cells narrow and linear-prosenchymatous, or below elongate and parenchymatous, at base rectangular and larger, all thin-walled; perichætial bracts linear from a wider base: seta slender, flexuous, orange to brown, about 1–1.5 cm. long; capsule inclined to pendulous, pyriform with a long narrow neck, altogether about 2.5 mm. long, the neck much wrinkled when old, and at least as long as the globose-oval part of the capsule, which is a lustrous orange- to dark chestnut-brown, the mouth rather wide; annulus wide; peristome-teeth yellowish, linear-lanceolate, the upper third suddenly narrower and sub-hyaline and papillose, trabeculate, lamellæ and divisural evident; segments about as long, carinately split and sometimes gaping; cilia 3, strongly appendiculate, about as long as segments, basal membrane one-third to almost one-half the height of the teeth; operculum convex-apiculate: spores smoothish, about .012–.015 mm.: usually synoicous: mature in June or July.

On moist shaded soil, old walls, shaded cliffs and rocks near trickling water, etc. Cosmopolitan. Rather common in our region.

Allegheny : On stone wall, Perrysville Avenue, Allegheny, May 26, 1909 (Figured); on cliffs along roadside, Stoop's Ferry, May 17, 1907; on decayed logs, Schenley Park, Pittsburgh, August 26, 1906. O. E. J.; in Ferguson's greenhouse, Allegheny, April 30, 1889. J. A. S.

McKean : Bennett Brook, on decaying log, December 2, 1894, and at Quintuple, June 15, 1896. D. A. B.

2. *WEBERA* Hedwig.

(*Pohlia* Hedwig).

Mostly paroicous or dioicous: paraphyses mostly present and filiform: robust to weak, gregarious or cespitose: stem mostly red; leaves more or less tufted on the fertile shoots, linear-lanceolate to lanceolate, non-bordered, towards apex more or less toothed; costa mostly incomplete; cells narrowly rhomboid-hexagonal to linear, the basal slightly more lax: seta long, slender, tortuous and twisted, at apex hooked or curved; capsule cernuous or pendulous, rarely erect, with short collum, obovate to oblanceolate or long-clavate; annulus mostly biseriate; peristome inserted near the mouth; teeth yellowish, papillose, with border narrow or none; segments mostly about as long, rarely rudimentary, often with a low basal membrane, often narrow, usually split but not fenestrate, cilia non-appendiculate, often rudimentary or lacking; spores mostly small; operculum convex-conic, umbonate or apiculate.

A world-wide genus of about 140 species, inhabiting soil, rocks, and decaying wood. Forty-six species in North America; at least 5 species in our range.

Key to the Species.

a. Leaf-cells very narrow: inner peristome with a low basal membrane, complete narrow segments, and cilia often rudimentary or none. b.

a. Leaf-cells narrow: basal membrane comprising one-third to one-half the height of the inner peristome; segments split, cilia well developed. c.

b. Paroicous; capsule long and slender with a long slender collum. 1. *W. elongata.*

b. Polyoicous; capsule oblong to pyriform with a rather short collum. 2. *W. cruda.*

c. Paroicous; not bearing gemmæ: costa hardly reaching the serrate apex. d.

c. Dioicous; often bearing gemmæ: costa incomplete or percurrent e.

d. Cilia two, not sub-appendiculate, articulate. 3. *W. nutans.*

d. Cilia three, distinctly sub-appendiculate. 3a. *W. nutans* var. *triciliata.*

e. Costa not reaching apex: capsule small and very short; stem not reddish. 4. *W. lescuriana.*

e. Costa percurrent: capsule larger and not so relatively short; stem reddish. f.

f. Gemmæ ovoid, obtuse or with short and not twisted points. 5. *W. annotina.*

f. Gemmæ long, narrow, with acuminate and often twisted points. 6. *W. proligera.*

1. **Webera elongata** [Hedwig] Schwaegrichen.

(*Pohlia elongata* Hedwig).

Gregarious to cespitose, bright pale green: stems erect, up to 2 cm. high, branching towards base; leaves crowded and larger in the comal tufts, lanceolate, erect-spreading, thin, the margin recurved below, the apex gradually narrowed, serrate; costa brownish, vanishing below or at the apex; leaf-cells narrow, linear-rhomboidal and vermicular above, hexagonal-rectangular below: seta long, slender, 2–4.5 cm. high; capsule sub-erect to horizontal, narrowly elliptic, pale, 2–5.5 mm. long, the neck slender and longer than the rest of the capsule, when dry and empty the capsule constricted below the mouth; operculum conic-acuminate or acutely rostellate; outer peristome yellowish, the inner with a basal membrane about one-third as high as the teeth; cilia two, more or less well-developed but always short and never appendiculate: paroicous; antheridia in pairs in axils of upper leaves: mature in August.

On earth and among rocks, in crevices, etc., where moist, usually in the mountains. Europe, northern Africa, Asia, North America from Greenland to the northern United States and Colorado. Rare in our range. We have seen no specimens from Pennsylvania, but it is reported as follows:

McKean : Bradford. (Porter's Catalogue).

2. **Webera cruda** [Linnæus] Schwaegrichen.

(*Pohlia cruda* Lindberg).

Robust, up to 6 or 7 cm. high, glaucous green and shining above, brownish below: stems red, simple, cespitose; the leaves below ovate, becoming linear-lanceolate in the comal tuft, erect-spreading, serrate towards the moderately acute apex, margin plane, rather rigid; costa reddish at base, not reaching apex; leaf-cells linear-prosenchymatous above, larger and rectangular at base, where often reddish: seta long; capsule oblong, with inconspicuous neck, often unsymmetric, mostly horizontal, castaneous or red-brown, when dry and empty ventricose at base and constricted at the mouth; operculum conic-apiculate; peristome yellowish, basal membrane one-third as high as teeth, cilia two or three, well-developed; usually autoicous, sometimes synoicous or dioicous: spores mature in summer.

On shaded earth, clefts in rocks, etc., usually in mountainous regions. Cosmopolitan but local in its distribution. In our region rare, being unknown from Western Pennsylvania, but reported from the eastern part of Pennsylvania and from Painesville, Ohio.

3. Webera nutans [Schreber] Hedwig.

(Plate XVII)

(*Pohlia nutans* Lindberg).

More or less densely cespitose, usually dark green: stems about 1–2 cm. high, branching by lateral innovations, or from the base, erect, matted with a castaneous tomentum below, reddish; leaves ovate below to much longer and linear-lanceolate in the comal tuft, hardly decurrent, the comal long-acuminate, the margin often somewhat recurved below, denticulate towards apex, leaves somewhat shrunken, twisted and lustrous when dry; costa strong, reddish, ending in or a little below apex; leaf-cells long-rhomboid and more or less pointed and prosenchymatous above, rectangular below, slightly narrower towards the margin: seta slender, flexuous, usually 2–3 cm. long, lustrous, castaneous below, often yellowish above; capsule horizontal to sub-pendulous, oblong to obovate, usually about 3–4 mm. in length, with a distinct but short neck, often gibbous when dry and then contracted below the wide mouth, yellowish to brown in age; operculum convex-mamillate; peristome-teeth orange-yellow below, paler and papillose in the rather abruptly narrowed upper half, strongly trabeculate, lamellate, divisural zigzag and distinct; segments about as long, carinately split and gaping below but remaining unsplit at apex; cilia nearly as long, two in number, filiform, articulate, basal membrane half as high as teeth; annulus wide, revoluble; spores smoothish, yellowish-pellucid, about .014–.016 mm., mature in early summer: autoicous; antheridia in axils of upper leaves.

On soil and decaying wood in moist places or swampy fields or woods. Cosmopolitan and common.

Allegheny : Power's Run, May 11, 1904, May 28, 1905, June 17, 1908, May 12 and 22, and June 17, 1909. O. E. J.

Armstrong : Kittanning, August 16, 1906. O. E. J.

Beaver : Beaver Falls, May 14, 1907. O. E. J.

Cambria: : Cresson, May 18, 1904, St. Lawrence, July 24, 1908. O. E. J.

Center : Barrens near Scotia, July 14, and Tussey's Mt., near Shingletown, July 15, 1909. O. E. J.

Crawford : Linesville, June 6, 1904, May 12 and June 12, 1908. O. E. J. Hartstown, May 29-30, 1909. O. E. J. and G. K. J.

Erie : Presque Isle, May 8-9, 1906 (Figured), and June 8-9, 1906. O. E. J.

Fayette	: Ohio Pyle, May 30, 1902. J. A. S.; Ohio Pyle, May 13, 1905, and June 14, 1908. O. E. J.
Indiana	: Cush Cushing Creek, Cherry Tree, July 11, 1908. O. E. J.
Lawrence	: Graceland Cemetery, New Castle, 1906. Miss Susan Gageby.
Montour	: Top of Montour Mt., July 17, 1908. O. E. J.
McKean	: Bradford, June 7, 1896, and Rutherford, June 19, 1896. D. A. B.
Washington	: Linn and Simonton. (Porter's Catalogue).
Westmoreland	: Chestnut Ridge, Hillside, May 23, 1908, and May 22, 1909. O. E. J.

3a. **Webera nutans** var. **triciliata** New Variety.

(Plate XVIII)

Plants laxly to densely cespitose, shining, dark green to yellowish: stem simple or sparsely branched, erect, castaneous, at the base reddish-radiculose, about 6–15 mm. high; lower leaves short, about 0.5–1.0 mm. long, costate almost to the apex, ovate, above the leaves becoming relatively longer and ovate-lanceolate, denticulate towards the apex; upper leaves clustered, erect-spreading, 2.5–4.0 mm. long, lanceolate, subdecurrent, denticulate at apex, acuminate, non-margined, strongly percurrently to excurrently costate; perichætial leaves elongate-lanceolate to linear, long-acuminate, denticulate at apex, excurrently costate; cells of the lower and median leaves incrassate, above the middle oblong-hexagonal to rhomboidal, about .010–.015×.035–.065 mm. elongate-rectangular at base where about .008–.020×.040–.100 mm.; cells of the comal and perichætial leaves incrassate, elongate to linear-prosenchymatous, about .008–.011×.040–.065 mm., towards the margin gradually narrower and there reaching .003–.006×.080–.100 mm., at the base elongate-rectangular: inflorescence paroicous, terminal; antheridia in the axils of the comal leaves: pedicel solitary, slender, lustrous, castaneous, erect (flexuous, about 4–6 cm. high: capsule horizontal to sub-pendulous, smooth, castaneous to yellowish-brown, ovate-oblong, often very slightly curved, 2.5–3.5 mm. long, when dry and empty contracted under the mouth, the basal third narrowed into a collum; exothecial cells incrassate, yellowish-pellucid, irregularly subquadrate to oblong-hexagonal or elongate-rectangular, about .025–.035×.035–.050 mm., in three to five rows under the mouth abruptly smaller, sub-quadrate, somewhat opaque, and about .006–.010×.012–.018 mm.; annulus broad, revoluble; operculum

rather wide, conic-mamillate; teeth of peristome linear-lanceolate, yellowish, articulate, strongly trabeculate, narrowly margined above, sub-hyaline and papillose at apex; segments of inner peristome nearly as long as teeth, hyaline, granular, carinately split and gaping, cilia three, as long as segments, filiform, strongly articulate and often sub-appendiculate, hyaline, granular; basal membrane reaching to middle of teeth; spores minutely roughened, yellowish-pellucid, .012–.015 mm. in diameter, mature in June.

On earth with more or less humus. Thus far known only as follows:

Butler : On earth under pines on rocky hillside, West Winfield, May 26, 1906. O. E. J.

Crawford : On hummocks of earth with Polytrichum, near Hartstown, July 26, 1908. O. E. J. *Type Specimen* (Figured).

4. **Webera lescuriana** (Sullivant) Jaeger.

(*Bryum pulchellum* Sullivant, not Hedwig.)

(Plate XVIII)

Gregarious to loosely cespitose, pale green: stems not red, ascending, usually simple, usually 1–1.5 cm. long; leaves small and remote below, gradually increasing in size and number above, the upper lanceolate, the comal linear-lanceolate, up to 2.5 mm. long, long-acuminate at the serrulate apex, the margins more or less recurved, the base non-decurrent; costa strong, reddish, ending below apex; leaf-cells elongate-rhomboid-hexagonal, prosenchymatous, rather thick-walled, the basal often reddish and tending to rectangular, the marginal slightly narrower: seta erect, 1–1.5 cm. long, yellowish-brown, lustrous, slender flexuous; capsule horizontal to abruptly pendent, short, 1.5–2 cm. long, yellowish-brown, the short tapering neck darker brown, capsule pyriform in general shape, when dry and empty widely flaring at the mouth; operculum conic-apiculate to mamillate; annulus revoluble; peristome rather short, teeth linear-lanceolate, yellowish-pellucid, abruptly narrowed above the middle to a sub-hyaline papillose apex, divisural and lamellæ present, trabeculæ strong, often a few connected by oblique or vertical bars; segments of inner peristome a little shorter than teeth, carinately split and gaping, cilia usually two, sometimes one, articulate, shorter than segments; basal membrane one-third the height of teeth; spores minutely roughened, about .015–.018 mm., mature in May: dioicous.

On wet clay or sandy soil, New Brunswick to Alabama and Arkansas. Probably not rare in our region.

Allegheny : Power's Run, May 7, 1905. O. E. J.

McKean : Quintuple, May 7, 1896. D. A. B.

Westmoreland: On damp clay with *Pogonatum*, slope of Chestnut Ridge, Hillside, May 22, 1909. O. E. J. (Figured).

5. **Webera annotina** [Linnæus] Schwaegrichen.

(*Pohlia annotina* Lindberg).

Loosely cespitose, light green: stems short, 1–2 cm., branching with slender stiff innovations from the base; leaves below small, lanceolate, non-decurrent, the upper longer, narrow-lanceolate, acuminate, margins somewhat recurved, serrulate at apex; costa nearly or quite percurrent, often reddish at base; leaf-cells rather thick-walled, narrowly rhomboid, small: seta red, flexuous; capsule small, about 2 mm. long, castaneous, the neck about as long as the rest of capsule, tapering, the whole capsule oval-pyriform, inclined to horizontal; annulus broad, revoluble; operculum conic-apiculate; mouth wide; peristome-teeth yellowish, segments widely carinately gaping, cilia in pairs, articulate; exothecial cells more or less collenchymatous: the sterile stems bearing in the axils of most of the leaves greenish, sub-sessile, clustered, ovate to ovoid gemmæ with short non-twisted points: dioicous.

Moist, sandy soil, especially among rocks in mountains. Europe, Algeria, Asia, and, in North America, from Greenland to British Columbia and south to New England, Pennsylvania, and Kansas. Rare in our region.

Beaver : Lesquereux. (Porter's Catalogue).

6. **Webera proligera** (Lindberg) Kindberg.

(*Pohlia proligera* Lindberg).

Gregarious to loosely cespitose, pale green: stems rather slender; leaves similar to those of *W. annotina* but somewhat longer and larger; gemmæ numerous in the axils of the upper leaves and differing from those in *W. annotina* in being longer and narrower and more or less fusiform with acuminate and often twisted points: the capsule has a shorter neck (Dixon and Jameson's Handbook) and the exothecial cells are not collenchymatous: dioicous: fruit rare.

This species inhabits sandy soil in moist situations, especially among rocks in mountains, as does also *W. annotina*, with which it has been considerably confused. It occurs in Europe, and, in North America, from northern Canada and Alaska to South Carolina and Minnesota. It is not yet reported in Western Pennsylvania but has been found along Lick Run in West Virginia, at the southern edge of our region.

3. *MNIOBRYUM* (Schimper, ex parte) Limpricht.

Dioicous, rarely polyoicous: weak to robust, loosely cespitose in brownish to whitish-green tufts, or gregarious: stems

erect, red, radiculose at base; leaves erect to erect-spreading, the upper lanceolate to lance-linear, the apex acute and distantly serrulate; costa mostly incomplete; cells lax and thin-walled; seta elongate, when dry sinistrorse, more or less hooked or curved at the top; capsule more or less pendent, usually short-pyriform, wide-mouthed, almost turbinate, exothecial cells mostly hexagonal and often broader than high; annulus none in our species; peristomes equal in length; teeth lanceolate, finely papillose, not prominently bordered; inner peristome yellowish, the basal membrane constituting one-half or more of its height; segments split, cilia 2–3, well developed, weakly articulate; spores medium size; operculum medium size, quite convex, often apiculate.

A genus of about 15 species, distributed over the whole earth, five of these being in North America, one in our range.

1. **Mniobryum wahlenbergii** [Weber and Mohr] New Combination.

(*M. albicans* Limpricht; *Webera albicans* Schimper; *Hypnum wahlenbergii* Weber and Mohr).

(Plate XVIII)

Cespitose in soft, large, glaucous or whitish-green tufts: stems usually 2–6 cm. long, more or less chestnut-red, especially in the older portion, slender, flexuous, branched and matted together with a brownish tomentum at base; leaves remote below, in the upper portion rather remote, about 2.5 mm. long, when dry somewhat shrunken but hardly twisted, spreading, widely ovate-lanceolate, at the base narrowed and somewhat decurrent, the margin plane and serrulate towards the obtusely acute apex; costa strong, reddish, ending a little below apex; leaf-cells rhombic-hexagonal, pellucid, about .015–.025 mm. wide, slightly narrower towards margin, tending to become inflated and rectangular at base but hardly distinctly so, the lowermost often reddish: seta erect-flexuous, 2-4 cm. high, slender, yellowish to reddish-brown, abruptly hooked at the summit; capsule pendent, shortly wide-pyriform, about 2.5 mm. long, reddish-brown when ripe, the neck short and wide, when dry and empty the capsule wide-mouthed; annulus none; peristome-teeth brownish-yellow, pellucid, strongly trabeculate, the trabeculæ often with oblique connections, the lamellæ and divisural indistinct, teeth lance-linear, papillose and subhyaline at apex; segments equal in length to teeth, narrow, carinately split, the cilia 2–4, sometimes more or less connected at apex, nearly as long as segments, papillose; basal membrane nearly reaching middle of teeth; spores smoothish, rather thin-walled, about .018–.024 mm.; operculum convex-apiculate; exothecial cells irregularly quadrate-hexagonal, yellowish-

pellucid, rather thin-walled, 2–3 rows at mouth much smaller and darker: dioicous; antheridial flower terminal, discoid, the perigonial bracts wide-spreading: mature in our region in May.

Almost a cosmopolitan in ditches, springs, or wet clay banks, etc. Rarely fruiting but rather common sterile.

Allegheny : Fern Hollow and Schenley Park, August, 1905. O. E. J.

Beaver : Near Beaver Falls, May 14, 1907. O. E. J.

McKean : Springy places, Quintuple, May 17, 1895. D. A. B. (Figured).

Westmoreland: Wet soil in niches of cliff, Saunders Station, June 21, 1907. O. E. J. and G. K. J.

4. *BRYUM* [Dillenius] Schimper.

Mostly synoicous: paraphyses present, filiform: perennial, small, robust, rarely gregarious, usually more or less densely cespitose: stem upright to ascending, often red, branching below the inflorescence, radiculose; lower leaves remote, upper leaves tufted, mostly erect-spreading, concave, oval or ovate to lanceolate, or elliptic to spatulate, mostly acute, often narrowed and decurrent at base, mostly bordered, entire or toothed towards the apex; costa mostly strong, often excurrent, projecting dorsally, provided with median guides; leaf-cells mostly rhombic- to rhomboid-hexagonal, the basal parenchymatous, quadrate to elongate-rectangular; perichætial leaves narrower and smaller inside: seta long, reddish to brown, hooked or arcuate at apex, capsule cernuous to pendent, rarely horizontal, the collum distinct, pyriform to cylindric, rarely ovoid to globose, symmetric to slightly curved, the curve sometimes being entirely in the collum, phaneropore, annulus present, large-celled, pluriseriate, revoluble; the two peristomes of nearly equal length, teeth confluent at their insertion, lanceolate to linear-subulate, often abruptly narrowed above the middle, yellowish to orange, often hyaline at apex and sometimes with a hyaline border, dorsally minutely papillose, trabeculæ sometimes united by cross-partitions; segments mostly free, basal membrane usually high, outwardly carinate, segments narrowly linear to lanceolate-subulate, split along the keel and more or less fenestrate or gaping, rarely entire; cilia filiform, rarely short or lacking, often appendiculate; spores .010–.050 mm.; operculum conic to convex-umbonate or rarely quite apiculate.

A large and difficult genus of about 850 species, of wide distribution; about 170 species in North America, of which there are 8 or 9 species in our range.

Key to the Species.

a. Leaves distinctly bordered. b.
a. Leaves not distinctly bordered, at least not above. i.
b. Costa vanishing below the apex. 9. *B. capillare.*
b. Costa percurrent to long-excurrent. c.
c. Leaves long-decurrent; costa short-excurrent. d.
c. Leaves short- or non-decurrent; costa long-excurrent. e.
d. Synoicous. 3. *B. bimum.*
d. Dioicous. 2. *B. pseudotriquetrum.*
e. Peristome-teeth with the trabeculæ connected by various cross-partitions. 1. *B. cernuum.*
e Peristome-teeth with trabeculæ unconnected. f.
f. Autoicous; antheridia at apex of lateral innovations. 6. *B. pallescens.*
f. Dioicous. g.
f. Synoicous. h.
g. Leaves ovate-lanceolate with rhomboidal cells. 7. *B. caespiticium.*
g. Leaves rounded to wide-obovate; cells short-hexagonal. 9. *B. capillare.*
h. Leaves non-decurrent; spores about .025 mm. 5. *B. intermedium.*
h. Leaves shortly decurrent; spores about .010—.014 mm. 4. *B. affine.*
i. Costa long-excurrent. 5. *B. intermedium.*
i. Costa vanishing a little above middle of leaf. 8. *B. argenteum.*

1. **Bryum cernuum** [Hornschuch] Bryologia Europæa. (*B. pendulum* Schimper; *Cynontodium cernuum* Hedwig).

(Plate XVIII)

Densely cespitose, usually darkish-green: stems in our region short, about 6–9 mm., erect, sparsely branched, matted below with a castaneous tomentum, stem reddish; leaves rather lax, somewhat tufted, close, erect-spreading, ovate-lanceolate, long-cuspidate-acuminate, more or less recurved on the borders, reddish at base, usually obscurely denticulate at apex, when dry rigid, shrunken and somewhat twisted; costa stout, reddish, long-excurrent; leaf-cells rather small, rhomboidal to somewhat elongate above, at base thin-walled, rather inflated, rectangular, at margin linear-prosenchymatous in 2–4 rows, forming a strong border: seta usually 3–4 cm. long, slender, flexuous, lustrous, castaneous; capsule pendulous, elongate oval-pyriform, usually 4–5 mm. long, tapering below into a neck about 1.5 mm. long, brownish, hardly contracted below the mouth except when dried prematurely; annulus 2–3-seriate, revoluble; operculum rather small, conic-apiculate; peristome-teeth linear-triangular, yellowish-pellucid below, sub-hyaline and papillose above, strongly trabeculate and with prominent

oblique or vertical connections between the plates, the lamellæ and divisural indistinct, the inner peristome more or less closely adherent to the teeth, the segments narrow, the cilia 2–3 and rudimentary, the basal membrane about two-fifths the height of the teeth; spores large, .024–.030 mm., yellowish-pellucid, minutely roughened; exothecial cells incrassate, yellowish-pellucid, irregularly rounded-quadrate to hexagonal, the upper four or five rows much smaller, rounded to transversely elongate, reddish-pellucid: synoicous: mature in June.

On earth, rocks, walls, and decaying logs. Temperate regions and mountains of Europe, Algeria, Asia, and North America from Greenland to Alaska and south to the northern United States. Rare in our region.

Allegheny : Sloping shaly hillside, Fern Hollow, Pittsburgh, June 8, 1909. G. K. J. (Figured).

2. **Bryum pseudotriquetrum** [Hedwig, p. p.] Schwaegrichen.

(*B. ventricosum* Dickson).

This species is practically similar to *Bryum bimum* in everything except that it is dioicous. According to Dixon and Jameson's Handbook the paler, more lax-leaved, and more flaccid plants usually belong to *B. bimum* while the more rigid and compact specimens are *B. pseudotriquetrum*,—but this is not always the case.

This species has much the same habitat and the same range as does *B. bimum*, but in our region seems to be rare. In Porter's Catalogue it is reported from Cresson, Cambria County, by James, and in the Carnegie Museum are specimens from two localities in McKean County which were distributed as this species, but which prove to be synoicous and typically *B. bimum*.

3. **Bryum bimum** [Schreber] Bridel.

(*Mnium bimum* Bridel).

(Plate XIX)

Rather loosely but deeply cespitose and matted together with a chestnut-colored tomentum: stems usually 3–6 cm. high, rather sparsely branching; leaves long-decurrent, 2–3. mm long, elliptic to oblong-lanceolate, shortly acuminate, the margins revolute almost to apex, serrulate above; costa reddish, strong, percurrent to excurrent; leaf-cells rhomboid-hexagonal, the basal inflated-rectangular, the marginal in three or four rows linear-prosenchymatous and more or less yellowish-pellucid, forming a distinct border; leaves when dry more or less shrunken, twisted, and appressed: seta 2.5–5.5 cm. long, slender, flexuous, lustrous, castaneous; capsule 3–5 mm. long, pendulous, brown, sub-cylindric, tapering to a neck which is but slightly shorter than the rest of capsule, slightly con-

stricted below the mouth when dry and empty, sometimes unsymmetrically up-curved; operculum broad, convex-mamillate: annulus large, revoluble; mouth deep chestnut, pellucid; peristome teeth linear-triangular, yellowish-pellucid below, subhyaline and papillose above, strongly trabeculate, lamellate, divisural zig-zag; basal membrane of inner peristome half the height of teeth, the segments a little shorter, hyaline, carinately split, cilia 3, strongly appendiculate; spores yellowish, .014–.016 mm., minutely "punctulate" or granular: synoicous: mature in July.

On wet soil, rocks, or decaying wood, in swamps or other wet places. Cosmopolitan; in our region more common in the mountains and in the swampy glaciated region towards the northwestern corner of Pennsylvania.

Allegheny	: Wildwood, June 11, 1908. O. E. J.
Cambria	: Flinton, July 23, 1908, and St. Lawrence, July 24, 1908. O. E. J. (Figured).
Center	: Scotia, Barrens near town, September 22, 1909. O. E. J.
Crawford	: Pymatuning Swamp, Linesville, June 12, 1908, and Hartstown, May 29-31, 1909. O. E. J.
Erie	: Presque Isle, May 8-9 and September 20-22, 1906. O. E. J.
Fayette	: Ohio Pyle, September 1-3, 1906, O. E. J. and G. K. J., and June 14, 1908. O. E. J.
Indiana	: James (Porter's Catalogue).
McKean	: Quintuple, June 13, 1897. D. A. B.

4. **Bryum affine** (Bridel) Lindberg.

(*B. cuspidatum* Schimper).

(Plate XIX)

Rather densely cespitose, becoming dark green: stem short, in ours usually 1–2 cm., occasionally longer, with slender innovations, somewhat matted with a brownish tomentum, dark brown; leaves rather numerous, somewhat clasping and shortly decurrent, the margins revolute to near the apex where the leaves are slenderly acuminate and more or less serrulate, the leaves ranging from oblong-lanceolate below to elongate ovate-lanceolate above and on the branches; when dry the leaves are moderately shrunken and twisted; costa strong, reddish, long excurrent; leaf-cells rhomboid-hexagonal above, to thin-walled, reddish, and more or less inflated-rectangular at the base, the marginal in two to five rows of linear-prosenchymatous more or less yellowish-pellucid cells forming a strongly marked border: seta slender, flexuous, lustrous-castaneous, about 2–4.5 cm. in height; capsule 3–4 mm. long, elongate

oblong-pyriform, with a tapering neck a little shorter than the rest of the capsule, yellowish-brown, finally deep brown, when dry and empty constricted below the deeper-colored mouth, more or less pendulous; operculum wide, convex-mamillate; annulus wide, revoluble; peristome-teeth linear-triangular, yellowish-pellucid below, sub-hyaline and papillose above, strongly trabeculate, lamellate, the zig-zag divisural usually faint; basal membrane of inner peristome about half the length of the teeth, the segments carinately split, hyaline and papillose, a little shorter than the teeth, the three filiform appendiculate cilia somewhat shorter than the segments; spores yellowish-pellucid, minutely roughened, usually about .010–.014 mm.; exothecial cells irregularly quadrate to rectangular-hexagonal, incrassate, three or four rows below the mouth being much smaller, rounded-quadrate and reddish-pellucid; synoicous: spores mature in summer.

Allegheny : Sewickley, May 21, 1889, J. A. S.; Power's Run, May 4, 1905. O. E. J. and G. E. K.; Stoop's Ferry, May 20, 1907. O. E. J. and G. K. J.

Erie : Presque Isle, May 8-9, 1906. O. E. J. (Figured).

Fayette : Laurelville, June 24, 1904. O. E. J.

Lawrence : Stop 78, S. and N. C. W. R. R., 1906. Miss Susan Gageby; Gorge below Ellwood City, June 26, 1909. O. E. J.

Somerset : Ursina, May 12, 1905. O. E. J.

Westmoreland: Derry, August 10, 1904. Miss Katherine R. Holmes; Hillside, May 19, 1906. O. E. J.

5. **Bryum intermedium** [Ludwig] Bridel.

(*Mnium intermedium* Ludwig; *Webera intermedia* Schwaegrichen).

(Plate XIX)

Densely cespitose, green, matted with dark-colored radicles: stems short, laterally branching by innovations, erect and with us usually about 3–5 mm. high; leaves tufted at apex of stem, erect-spreading, concave, oblong- to ovate-lanceolate, the margins recurved, almost entire, base sometimes reddish, only slightly decurrent, in our specimens about 1.5–2 mm. long, the costa excurrent into a long entire or denticulate acumen: leaf-cells rhomboidal above, thin-walled and rectangular at base, the marginal in one to three series of linear-prosenchymatous cells forming a somewhat indistinct border, sometimes the middle cells merely narrow gradually towards the margin: seta in our specimens 1.5–3.0 cm. long, flexuous, slender, lustrous, castaneous; capsule about 3 mm. long, ellip-

tic-pyriform, tapering below into a neck almost as long as the rest of the capsule, brown, often somewhat unsymmetric and incurved, scarcely constricted below mouth when dry and empty; mouth darker red or brown; annulus rather narrow, revoluble; peristome-teeth linear-lanceolate, yellowish-pellucid below, sub-hyaline and papillose above, strongly trabeculate, lamellate and with faintly distinct divisural, inserted below the mouth; inner peristome with carinately gaping segments almost as long as the teeth, cilia three, strongly appendiculate, considerably shorter than segments; spores smoothish, yellowish-pellucid, about .024–.027 mm.; exothecial cells rectangular below, irregularly quadrate to hexagonal above, the three to five upper rows much smaller, rounded-quadrate, brownish-pellucid, all incrassate; operculum conic, obtuse to apiculate: synoicous: mature in June and July.

Crevices of walls and cliffs and on wet, sandy earth: Europe, Asia, North America through Canada and to the northern United States. Not very common.

Allegheny	: Wet soil in crevices of cliff, Power's Run, April 18, 1906. O. E. J. (Figured).
Beaver	: On rotten log, Beaver Falls, May 11, 1907. O. E. J.
Cambria	: James. (Porter's Catalogue).
McKean	: On stump in swamp, Clarkdale Park, Bradford, June 20, 1897. D. A. B.

6. **Bryum pallescens** [Schleicher] Schwaegrichen.

(*B. turbinatum* Drummond).

(Plate XIX)

Sub-cespitose, yellowish-green: stems short, 4–9 mm., sparsely branching, reddish, somewhat reddish-tomentose below, erect; leaves small and remote below, tufted above, ovate below to ovate- or linear-lanceolate above, non-decurrent to sub-decurrent, erect-spreading, when dry more or less shrunken, twisted, and appressed, reddish at base, margins recurved, apex obscurely denticulate, cuspidate-acuminate; costa strong, reddish, long-excurrent; leaf-cells rhomboid to elongate, thin-walled and rectangular at base, the margin wide and formed of several rows of linear-prosenchymatous incrassate cells: seta erect, slender, flexuous, lustrous-castaneous, in our specimens about 2 mm. long: capsule oblong-pyriform, about two-fifths neck, horizontal to sub-pendulous, contracted below the mouth when dry, brown; annulus wide, revoluble; lid conic-apiculate; teeth of the peristome yellowish-pellucid, towards apex sub-hyaline and papillose, linear-triangular, strongly trabeculate, lamellæ and divisural rather indistinct; segments of inner peristome slightly shorter, carinately split, cilia 3,

strongly appendiculate, slightly shorter than segments, basal membrane one-half height of teeth; spores yellowish-pellucid, smoothish or minutely roughened, about .014–.016 mm.; exothecial cells incrassate, rectangularly quadrate or hexagonal, the upper three or four rows much smaller and rounded to transversely elongate and darkly reddish-pellucid: gonio-autoicous,—antheridia in apex of the lateral innovations: mature in May or June.

In crevices of walls and sandstone rocks. Europe, Asia, northern Africa, North America from Greenland to British Columbia and south to the northern United States. Rare in our region.

Allegheny : On debris in rock-crevices along sandstone cliff facing the Allegheny River at Power's Run, April 28, 1907. O. E. J. (Figured).

7. **Bryum caespiticium** [Linnæus] Hedwig.

(Plate XX)

Densely cespitose, yellowish-green: stems erect, rarely more than 1 cm. high with us, branching by lateral innovations, brownish-tomentose below, reddish above; leaves remote and small below, the upper densely tufted, ovate to lanceolate or narrower within, concave, narrowly acuminate, borders recurved, the apex slightly denticulate or sometimes entire, the base often reddish, the comal reaching 3–3.5×1 mm., when dry but little shrunken or twisted; costa strong, reddish, long-excurrent; leaf-cells narrow-rhomboid, becoming larger and rectangular at base, the marginal in one to three rows of linear-prosenchymatous incrassate cells but not forming a very pronounced border: set erect, slender, flexuous, lustrous-castaneous, about 2–4 cm. long, rarely more; capsule oblong-pyriform, 3–3.5 mm. long, yellowish-brown to darker with age, the neck comprising almost one-half the capsule, horizontal to pendulous, sometimes unsymmetrically up-curved, constricted below the mouth when dry and empty; the mouth darker colored; peristome-teeth yellowish-pellucid below, paler and minutely papillose above, linear-lanceolate; segments of inner peristome almost as long, somewhat yellowish, carinately split and gaping, cilia as long as segments or almost so, strongly appendiculate, basal membrane about two-fifths the height of teeth; spores about .012–.017 mm., smoothish, yellowish-pellucid; exothecial cells incrassate, rectangular below to irregularly quadrate-hexagonal above, the upper three or four rows much smaller and rounded-quadrate to laterally elongate and colored; operculum usually orange-brownish, mamillate to conic-apiculate: dioicous: mature in May to June or July.

A cosmopolitan common on earth in pastures, etc., also on dry banks, stones, walls, etc.

Allegheny	: Vacant lot, Pittsburgh, May 31, 1905. O. E. J.
Butler	: Bank of Buffalo Creek, West Winfield, May 26, 1906. O. E. J.
Center	: Sandy Barrens near Scotia, July 16, 1909. O. E. J.
Clinton	: Roadside, Lock Haven to Vilas, July 15, 1908. O. E. J.
Huntingdon	: Hillside near Birmingham, May 17, 1904. O. E. J.
Mercer	: West Branch, April 14, 1894, and along retaining wall, foot of Cliff Street, Bradford, May 26, 1897. D. A. B.
Westmoreland	: Chestnut Ridge, above Hillside, May 23, 1909. O. E. J. (Figured).

8. **Bryum argenteum** [Linnæus] Hedwig.

(Plate XX)

More or less densely cespitose, more or less whitish and silvery green: stems short, radiculose, with numerous lateral innovations; leaves closely imbricated, deeply concave and so numerous that the branches are terete and julaceous, leaves small, about 1 mm. long, widely ovate or obovate, slightly or not at all decurrent, margins plane, entire, acute to long-acuminate, when dry silvery shining and hardly altered in shape; costa thin, wide, disappearing in upper third of leaf; leaf-cells rhomboid-hexagonal above, below rectangular, all somewhat pellucid and incrassate, the lower half of the leaf more or less chlorophyllose, the upper half colorless: seta slender, lustrous, usually chestnut-colored below, pale above, often dark when old, flexuous, 1–1.5 cm. long; capsule about 2 mm. long, oblong, the neck short and hardly tapering, by a quick turn at the apex of the seta pendent and often touching the seta at its wider part, somewhat constricted below the mouth when dry and empty, dark brown when old; annulus wide, revoluble; peristome-teeth linear lanceolate, yellowish-pellucid, hyaline at apex, trabeculate, lamellate, divisural zigzag; segments nearly as long, carinately split and gaping, faintly yellowish-pellucid, cilia as long as segments, three in number, appendiculate, basal membrane half as high as teeth; exothecial cells quadrate to hexagonal, densely incrassate and orange-pellucid, the upper eight to ten rows smaller, less densely incrassate, rounded-quadrate to laterally elongate; operculum convex, apiculate, orange; spores .010–.014 mm., smoothish, yellowish-pellucid: dioicous: mature in October to November.

Cosmopolitan, common on dry earth, crevices of brick pavements and walls, soil-covered rocks, etc.

Allegheny	: Brick pavement, Pittsburgh, October 12, 1907, Carnot, October 11, 1908, and on old camp-site, Wildwood Hollow, November 19, 1908. O. E. J.
Beaver	: Roadside, near Smith's Ferry, October 1, 1910. O. E. J.
Crawford	: Linesville, May 12, 1908. O. E. J.
Erie	: On sand-plain, Presque Isle, September 20, 1906. O. E. J.
Fayette	: Cheat Haven, September 3-6, 1910. O. E. J.
Huntingdon	: Near Union Furnace, July 21, 1908. O. E. J.
McKean	: Bennett Brook, March 4, 1894. D. A. B.
Westmoreland	: Saunders, June 21, 1907. O. E. J. and G. K. J.; Mellon's summer home, Laurel Hill Mts., New Florence, September 8-11, 1907. O. E. J. (Figured).

9. **Bryum capillare** [Linnæus] Hedwig.

(*Mnium capillare* Linnæus).

(Plate XX)

Rather densely cespitose, soft, light green: stems low, in our specimen about 5 mm. high, reddish below, radiculose at base, erect, rather stout, sometimes branching at base: leaves rather dense, spreading, not forming a very distinct comal tuft, soft, widely obovate-spatulate or rounded with a narrowly oblong base, the apex abruptly acuminate, margins plane; costa rather wide, reddish at base, in the lower leaves and younger plants ending below the apex but in upper leaves of older plants excurrent-acuminate to piliferous; leaf-cells rhomboid-hexagonal, thin-walled, the marginal in one to several rows elongated and narrow, forming a rather indistinct border, the upper marginal projecting to form low denticulations, the basal parenchymatous, rectangular, those near the costa in the middle of the leaf more or less inflated: seta rather long; capsule rather large (about 5 mm.) with a distinct neck comprising about one-third the length of the capsule, which is subcylindric, usually symmetric, horizontal to sub-pendulous, reddish to chestnut-color; operculum conic-apiculate, reddish-orange; peristome large, reddish: typically dioicous: mature in July or August.

On leaf-mould and loamy soil in woods, often on bases of trees and on ledges,—almost cosmopolitan.

McKean : Quintuple, July 15, 1896. D. A. B. (Figured).

Washington : Linn and Simonton, (Porter's Catalogue).

5. *RHODOBRYUM* (Schimper) Hampe.

Dioicous or rarely polyoicous: very robust plants of *Mnium*-like aspect, gregarious to loosely cespitose: stem ascending from subterranean rhizome-like stolons; lower leaves remote, mostly scale-like and imbricated, comal leaves large, spatulate, bordered, sharply doubly serrate above, forming terminal rosettes; costa broad, narrowing above and disappearing just below apex in most species; leaf-cells rhombic- to elongate-hexagonal, at the base elongate-rectangular; perichætial leaves smaller, lanceolate, long-acuminate: seta single or in twos or threes, elongate, brownish, more or less hooked at apex; capsule horizontal to pendent, oblong-cylindric, slightly arcuate, collum short; annulus broad and revoluble or narrow and deciduous in pieces; peristome-teeth confluent at their insertion, lanceolate to linear-subulate, yellowish- to reddish-brown, hyaline above, somewhat bordered, and finely papillose; segments free, yellowish, broadly lance-subulate, fenestrate to gaping along the keel; basal membrane high and carinate outwards; cilia filiform, long-appendiculate; spores .014–.024 mm.; operculum convex-apiculate.

A widely distributed genus of over 50 species; 7 species occur in North America, one being in our range.*

1. **Rhodobryum ontariense** (Kindberg) Paris.

(*R. roseum* Lesquereux and James, Manual, pp., not *R. roseum* [Weis] Schimper*; *Bryum ontariense* Kindberg).

(Plate XX)

Gregarious to loosely cespitose, deep green: stems erect from long creeping rhizome-like stolons, 2–5 cm. high, stout, with minute appressed bract-like leaves up to the summit, where the leaves suddenly enlarge to form a conspicuous rosette about 1 cm. across; comal leaves numerous, obovate-spatulate from a narrow base, the apex suddenly narrowed and acuminate and more or less twisted, the margin revolute for about three-fourths the length of the leaf and in the upper part prominently sharply spinulose-dentate; costa strong, mostly plainly excurrent; leaf-cells rather large, elongate-hexagonal, the walls medium, towards the base larger, thinner-walled, more or less hyaline, rectangular: setæ 1-3 to a perichætium, erect, lustrous, castaneous, 2–4 cm. long; capsule pale brownish, oblong-cylindrical, about 4–5 mm. long, in-

R. roseum [Weis] Schimper differs in having the costa ceasing below the apex: evidently does not occur in our region, perhaps not at all in northeastern United States.

curved, somewhat constricted below the mouth when empty, at the base having a narrow incurved collum about one-third the length of the rest of the capsule, the capsule horizontal to sub-pendulous; peristome-teeth large, linear-lanceolate, narrowly bordered, yellowish, hyaline and papillose above, strongly trabeculate, lamellate with distinct divisural; segments about four-fifths as long, carinately split and gaping; cilia 3, about as long as segments, strongly appendiculate; basal membrane about two-fifths the height of teeth; spores yellowish, minutely roughened, about .014–.018 mm.; operculum convex-apiculate; exothecial cells incrassate, rectangular to irregularly rounded, towards the mouth in several rows very much smaller, very strongly incrassate and darker; dioicous: mature in September and October.

On rotten logs and rich humus in woods, sometimes on stones. Southeastern Canada and northeastern United States. Not uncommon in our region, but rarely found in fruit.

Allegheny	: Moon Township, 1889. J. A. S. (Figured).
Cambria	: Flinton, July 24, 1908. O. E. J.
Crawford	: Linesville, Pymatuning Swamp, June 11-12, 1907. O. E. J.
Fayette	: Ohio Pyle, September 1-3, 1907, O. E. J. and G. K. J.; May 30-31, 1908. O. E. J.
McKean	: Toad Hollow, Bradford, November 26, 1896. D. A. B.
Somerset	: Allegheny Mountain, August 11, 1876. B. H. Patterson.
Washington	: Hanlin, May 21, 1908. O. E. J.

Family XV. *MNIACEAE*

Synoicous or dioicous, rarely autoicous; male flowers disk-like with club-shaped paraphyses: female flowers bud-like with filiform paraphyses: mostly robust, cespitose: stem with a central strand, radiculose below, mostly erect, frequently stoloniferous; comal leaves large and mostly spreading in a terminal rosette, lower and stoloniferous leaves smaller and somewhat dissimilar: costa strong, broad at base, tapering upwards and ending below or in the apex, rarely toothed dorsally; cells parenchymatous, mostly hexagonal or rounded, smooth, uniform in size or gradually smaller towards the margin; perichætial leaves erect, much smaller in size, non-margined, costate: seta long, stiff, smooth, mostly shortly hooked above; capsule mostly cernuous or pendent, rarely erect, symmetric, oblong-ovoid to cylindric, rarely globose, sometimes arcuate, collum short; annulus mostly biseriate and revoluble; peristome double and mostly complete as in *Bryum;* spores mostly large; operculum convex to obliquely rostrate; calyptra cucullate, narrow, mostly fugacious, smooth.

Distributed over the whole earth, most abundant in damp woods and swamps, on earth, bark of trees, or rocks, in the temperate zones. Five genera, of which but one occurs in our region.

I. *MNIUM* Linnæus, Hedwig.

Synoicous or dioicous, rarely autoicous: mostly robust, cespitose in bright green to dark green or later brownish tufts; stem erect, often stoloniferous, often bearing creeping flagelliform branches; leaves bract-like and remote below, increasing upwards to the terminal rosette, broadly ovate, obovate, or oblong, to spatulate from a narrow decurrent base, when dry contorted to crispate, when wet erect-spreading to recurved, mostly with a border of 1–3 layers of elongate prosenchymatous colored cells, each layer of the border usually sharply serrate; costa stout; cells rounded to hexagonal, often collenchymatous and punctate, uniform or smaller towards the margin: seta single or clustered, long; capsule cernuous to pendent, rarely erect, mostly oblong-ovoid, rarely arcuate; exothecial cells rounded, annulus revoluble; teeth strong, separate at base, greenish-yellow to reddish-brown, more or less papillose, the zigzag divisural line distinct, the dorsal plates low, the trabeculæ numerous, often united by sporadic cross-walls; inner peristome mostly yellowish-red, the basal membrane half-way to the apex and sometimes perforate; segments usually as long as the teeth, lanceolate, mostly abruptly subulate, usually fenestrate and finally gaping; cilia complete, mostly articulate; spores .016–.048 mm.; operculum convex to conic and rostrate; calyptra narrowly cucullate.

About 90 species, cosmopolitan, on various sub-strata, usually in moist or shaded situations; 32 species occurring in North America, about 11 species in our range.

Key to the Species.

a. Leaves not distinctly bordered. b.
a. Leaves distinctly bordered. c.
b. Margin with a single series of low irregular teeth in the upper half; cells incrassate. 9. *M. stellare.*
b. Margin not distinctly toothed; cells thin-walled. 11. *M. cinclidioides.*
c. Leaves with entire or almost entire margin. d.
c. Leaves with serrate margin. g.
d. Border indistinct and of one series of cells only. 11. *M. cinclidioides.*
d. Border of 2–4 series of cells in several layers. e.
e. Lid acutely rostrate; leaves obovate. f.
e. Lid conic-apiculate; oblong to oval or sub-orbicular. 8. *M. affine* var. *rugicum.*
f. On stones; leaves usually minutely apiculate and percurrently

costate. 10. *M. punctatum.*
f. In swamps; leaves not usually apiculate and costa not usually reaching apex; often very large. 10. *M. punct.* var. *elatum.*
g. Leaves serrate with a single row of teeth. h.
g. Leaves serrate with a double row of teeth. k.
h. Leaves serrate only in upper two-thirds. 6. *M. cuspidatum.*
h. Leaves serrate to the base or very nearly so. i.
i. Teeth slender and usually of 2–4 cells. 8. *M. affine* var. *ciliare.*
i. Teeth usually of but one cell and not so slender. j.
j. Leaf apex bluntly rounded, abruptly apiculate. 5. *M. rostratum.*
j. Leaf apex more or less acute and cuspidate. 7. *M. medium.*
k. Leaves lanceolate; costa incomplete, dorsally toothed. 1. *M. hornum.*
k. Leaves wider than lanceolate; costa usually complete in upper leaves at least. l.
l. Costa toothed dorsally. m.
l. Costa not toothed dorsally. n.
m. Cells not collenchymatous, about .014–.018 mm. 2. *M. orthorrhynchum.*
m. Cells collenchymatous, about .020–.030 mm. in diameter. *M. lycopodioides.**
n. Cells rounded and strongly collenchymatous. 3. *M. serratum.*
n. Cells angled and not collenchymatous. 4. *M. spinulosum.*

1. **Mnium hornum** Linnæus, Hedwig.

(*Astrophyllum hornum* Lindberg).

A robust species in dense tufts, with erect unbranched stems and terminal rosettes of leaves which reach a length of 3–5 mm. but are oblong- to narrowly elliptic-lanceolate, acute, sharply apiculate, all leaves with a reddish, thickened border, sharply doubly spinosely serrate in the upper half; the costa ending below the apex and spinose dorsally above; leaf-cells incrassate, angular, not very regularly seriate, rather small: seta solitary, long; capsule subpendulous, finally horizontal, ovate-elliptic and tapering to a distinct neck, when old pale yellowish with a red mouth; operculum conic-apiculate: dioicous, the antheridial flowers being disc-like. The leaves are proportionally narrower than the other species of the genus and the calyptra often remains for a time clasping the seta just below the capsule, mature in April to May.

In shaded, swampy or springy places and banks of streams: Europe, Algeria, Japan, North America from Newfoundland

**Mnium lycopodioides* (Hooker) Schwaegrichen, as reported from Blair and Elk Counties in our region (Porter's Catalogue), is probably synonymous with *Mnium pscudo-lycopodioides* C. Mueller and Kindberg, which appears to be hardy separable from *Mnium orthorrhynchum* (Bridel) Bryologia Europæa.

to Georgia and west to Wyoming. (Lesquereux and James in their manual say: "More generally on quartz or schistose rocks.") Although frequently reported from the eastern part of Pennsylvania, the only report of this species in our region is:

Cambria : James. (Porter's Catalogue).

2. **Mnium orthorrhynchum** (Bridel) Bryologia Europæa. (*Astrophyllum orthorrhynchum* Lindberg).

Quite similar to *M. serratum* but the leaf-cells only about .015–.018 mm.; densely tufted; leaves close, oblong-lanceolate, doubly spinose-serrate from below the middle; costa usually ending in the apiculation, toothed dorsally above; leaf-cells angular, hexagonal to quadrate, incrassate, non-collenchymatous: seta solitary, red; capsule elliptic-oblong, tapering into the neck, straight and more or less horizontal, brownish; operculum shortly rostrate: dioicous, antheridial flower discoid. Mature in late summer.

On moist rocks, usually calcareous, along cool shaded ravines and streams: Europe, Asia, North America from Greenland to British Columbia south to Colorado, Montana, New York, and Pennsylvania. In our region one report:

Blair : Porter. (Porter's Catalogue).

3. **Mnium serratum** Schrader, Schwaegrichen. (*M. marginatum* Beauvois; *Astrophyllum marginatum* Lindberg). (Plate XXI)

Loosely cespitose in soft tufts, rather dark green: stems and lower leaves often deep reddish tinged, stems slender, rather short, usually 1.5–3 cm. in our specimens, simple or branched below with erect branches; leaves rather remote, strongly decurrent, the lower ovate-lanceolate, the upper oblong spatulate-lanceolate, all acute and apiculate, the strong red border sharply doubly serrate, the leaves when dry more or less twisted but hardly crispate; costa in upper leaves confluent with the border in the apiculus but in the middle and lower leaves and often even the upper leaves of sterile shoots the costa ends below the apex, not spinose; leaf-cells from .020–.030 mm. in diameter, irregularly rounded, somewhat incrassate, strongly collenchymatous, the basal elongate: seta mostly single; capsule horizontal, yellowish to brown, oval-oblong, tapering at neck; peristome yellow or sometimes brown, inserted, the teeth lance-linear, pellucid yellowish-brown, papillose above, strongly trabeculate, divisural faint; segments a little shorter than teeth, papillose above, slender, cilia 3 (2), the basal membrane reaching somewhat above the middle; spores, smooth, rounded, about .025–.030 mm.; operculum stoutly short-rostrate: synoicous: mature in spring.

Usually near streams on shaded banks or in crevices of rocks where moist, in Europe, northern Asia, and, in North America, from Anticosti to Alaska and south to northern United States.

Allegheny : Schenley Park, Pittsburgh, September 15, 1905. O. E. J.

McKean : Hawkins and Quintuple, August 2, 1895. D. A. B. (Figured).

Washington : On shale cliff in narrow ravine, Hanlin, May 21, 1908, and N. Branch Maple Creek, Charleroi, April 24, 1908. O. E. J.

4. **Mnium spinulosum** Bryologia Europæa.

Similar in many respects to *Mnium serratum,* the leaves obovate to spatulate at the apex of the stem, clustered above, decurrent, acute, sharply doubly serrate on the thickened reddish border in the upper two-thirds; costa percurrent, not dorsally toothed, often ending below the apex in the lower and middle leaves; leaf-cells about .020–.030 mm., angled hexagonal, or below rectangular, incrassate, non-collenchymatous: synoicous: sporophytes either single or clustered; seta erect; capsule horizontal or inclined, ovate-oblong, light yellowish, the peristome forming a prominent red border at the mouth; operculum rostrate.

On the ground in evergreen woods, usually in mountainous or hilly regions. Europe and northern North America, from Nova Scotia to Alaska and south to the northermost United States. It is reported from eastern Pennsylvania and from Ohio but not yet from our region.

5. **Mnium rostratum** Schrader, Schwaegrichen.

(*Astrophyllum rostratum* Lindberg).

Large, loosely cespitose, stoloniferous: stems erect, short, the sterile shoots creeping or arched; leaves broadly oblong or slightly obovate, rounded at both ends, tapering but little at base, at the apex very broadly rounded or almost truncate, short apiculate, the border strong, brownish, serrate in the upper half with a single row of short obtuse or almost obsolete teeth; the comal leaves large, up to 5 mm. long, those of the sterile shoots complanate-two-ranked; costa excurrent in the short apiculus; leaf-cells incrassate, collenchymatous, about .025–.030 mm., rounded-hexagonal, not radiating in rows from the costa as in *affine* var. *rugicum,* which in the sterile condition it closely resembles: capsules usually 1–3, clustered, subpendulous to horizontal, yellowish, operculum long rostrate; peristome-teeth yellowish, the inner peristome orange: synoicous: mature in spring.

On wet rocks and earth in woods: almost cosmopolitan in the temperate zones, in North America from central and

southern Canada south to Virginia, Pennsylvania, Ohio, Montana and Oregon.

All Pennsylvania specimens in the Carnegie Museum Herbarium which were labeled *M. rostratum* are non-collenchymatous and the leaf-cells are definitely arranged in series radiating from the costa. The species is reported from our region as follows:

Cambria : James. (Porter's Catalogue).
Lycoming : McKimm. (Porter's Catalogue).

6. **Mnium cuspidatum** Linnæus, Hedwig.
(*Mnium sylvaticum* Lindberg).
(Plate XXI)

Loosely cespitose in large light to dark patches: stems branching with sterile shoots prostrate or sub-erect, in our specimens usually about 1.5–3 cm. high, reddish, radiculose below; leaves decurrent, oblong-oval, acute, the upper tending to obovate, those on the branches more rounded or oval, all shortly cuspidate and serrate in the upper half or two-thirds with a single row of short one-celled teeth, occasionally some teeth two-celled, the border of 3–5 rows of incrassate, linear, yellowish-pellucid cells; costa confluent with the border in the apiculate apex or ending a little below the apex; leaf-cells about .020–.025 mm., incrassate, somewhat collenchymatous, hexagonal to somewhat rounded, the basal tending to rectangular: seta solitary, pale yellowish or brownish, erect; capsule pale yellowish or brownish, sub-pendulous, oblong-oval, rather abruptly narrowing to the seta, the base and mouth brown; operculum conic-obtuse; teeth yellow, lance-linear, papillose above, divisural indistinct; inner peristome a little shorter, the basal membrane extending to the middle or a little above, the basal part of the segments more or less irregularly fenestrate with rounded holes, the upper part of the segments finally gaping or breaking apart; cilia three, linear, somewhat appendiculate, the inner peristome brownish-pellucid, the tips of the segments and the cilia being paler and papillose; spores rounded, faintly papillose, yellowish, about .030 mm. in diameter: synoicous, mature in May.

In moist woods on earth, stones, rotten logs, etc. Common and widely distributed over the temperate parts of Europe, Asia, and of North America.

Allegheny : Moon Township, April, and May 18, 1902. J. A. S.; Power's Run, April 28, 1907, and Schenley Park, Pittsburgh, May 29, 1907. O. E. J. and G. K. J.; Aspinwall, April 9, 1905, October 25, 1908, Fern Hollow, January 21, 1906,

	Library, April 29, 1906, Power's Run, May 18, 1907, and April 16, 1910, Brush Creek, April 26, 1908, Montrose, September 21, 1905. O. E. J.
Beaver	: Beaver Falls, May 11, 1907. O. E. J.
Butler	: Winfield Junction, June 7, 1902. J. A. S.; Crider's Corners, April 26, 1908. O. E. J.
Crawford	: Pymatuning Swamp, Linesville, May 18, 1905, June 12, 1905, and May 12, 1908. O. E. J.; Near Mud Lake, Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
Erie	: Presque Isle, on leaf mould in oak woods, May 8-9, 1906. O. E. J.
Fayette	: Ohio Pyle, May 12, 1905, May 30, 1908, (Figured), and June 13, 1908. O. E. J.; Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
Huntingdon	: Birmingham, May 17, 1904. O. E. J.
Lawrence	: Slippery Rock Creek, above Wurtemberg, October 16, 1910. O. E. J. and G. K. J.; Slippery Rock, 1906. Miss Susan Gageby.
Mercer	: Houston Junction, July 12, 1902. J. A. S.
McKean	: Bennett Brook, April 7, 1893, and May 8, 1897, West Branch, April 7, 1893, Quintuple, June 15, 1896. D. A. B.
Somerset	: Ursina, May 12, 1895. O. E. J.
Washington	: Three miles south of Library, April 22, 1906, North Branch Maple Creek, Charleroi, April 24, 1908, Hanlin, May 21, 1908. O. E. J.

7. **Mnium medium** Bryologia Europæa.

(*Astrophyllum medium* Lindberg).

(Plate XXI)

Widely and rather loosely cespitose, large, light to dark green: stems erect, up to 5 cm. in our specimens, branching at the base, densely covered with a brown felted tomentum, sterile shoots long and prostrate or ascending; leaves distant, little shriveled when dry, ovate to oblong, somewhat narrowed and slightly decurrent at base, rather obtuse at apex, cuspidate, narrowly margined all around, sharply serrate from near the base with mainly one-celled teeth, the comal leaves rosulate, and up to 5×15 mm.; costa reddish, strong, excurrent cuspidate; leaf-cells large, rounded above to elliptic-hexagonal towards base, the margin consisting of about two rows of

linear, much incrassate, more or less colored cells, the laminal cells all incrassate and collenchymatous: synoicous: capsules clustered, occasionally single, on erect stout setæ, pendent, oblong; operculum convex, rostrate-apiculate: mature in May.

Mostly on wet rocks and shaded damp earth and logs; cooler Europe and Asia, and, in North America, from Greenland to Alaska and south to New Jersey, Pennsylvania, Minnesota, Idaho to California.

In Pennsylvania found only in Monroe County and:

McKean : On leaf-mold, etc., at headwaters of Marilla Brook in wet, springy places, September 24, 1894 (Figured), West Branch Swamp, May 26, 1895, Bradford, November 2, 1898. All D. A. B.

8. **Mnium affine** Blandow, Schwaegrichen.
(*Astrophyllum cuspidatum* Lindberg).

As Grout points out in his "Mosses with Hand-lens and Microscope," the true *Mnium affine* Blandow is rare in eastern United States, and it apparently has not yet been found in Pennsylvania. It has the capsules usually clustered, 2–4 together, and the teeth of the leaves shorter than in the variety *ciliare*. Its general range is Europe, Asia, and North America south to New Jersey, West Virginia, and Washington.

8*a*. **Mnium affine** var. **ciliare** (Greville) C. Mueller.
(*Astrophyllum ciliare* Lindberg; *Bryum ciliare* Greville).
(Plate XXII)

Moderately large, loosely cespitose, pale to dark green with age: stems erect, usually about 3 cm. high, reddish-brown, rather stout, radiculose below, with long, slender sterile shoots which are prostrate or arched; stem-leaves ovate, varying to oblong-elliptic or at the apex rosulate and obovate to narrow spatulate, somewhat acute, apiculate, up 6–10 mm. long, decurrent, margined, serrate down to the narrowed base with long slender teeth of 2–4 cells; costa excurrent-apiculate, strong; leaf-cells large, .020–.040(–.070) mm. in diameter, angled, somewhat incrassate, hexagonal to irregularly somewhat elongate rectangular, especially towards the base, hardly collenchymatous, marginal cells prosenchymatous-linear and cartilaginous pellucid, often yellowish to reddish: seta single, erect flexuous, strong, reddish, about 2.5 cm. long; capsule pendent, elliptic-oblong, about 4 mm. long, narrowed to a short darker colored neck, yellowish-brown; lid conic-apiculate; peristome-teeth pale pellucid, strongly trabeculate, the divisural rather faint, finely papillose above; inner peristome brownish pellucid, the basal membrane reaching about half-

way, non-fenestrate, the segments and usually three cilia finely papillose above and often exceeding the teeth; spores round, yellowish-pellucid, finely papillose, about .028–.030 mm.; dioicous; antheridial flower terminal-discoid; mature in May.

On rocks and soil in swamps and moist woods, Asia, Europe, and in North America through southern Canada south to Georgia, Louisiana, Missouri, Montana, and California.

Crawford : On rotten stump in swampy woods, Linesville, June 12, 1907. O. E. J.

Fayette : Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

McKean : Langmade, May 29, 1898, and Bolivar Run, September 11, 1898. D. A. B. (Figured, as to fruit).

Washington : Washington, Linn and Simonton. (Porter's Catalogue).

Westmoreland: "Rachelwood," New Florence, September 8-11, 1907. O. E. J.

8*b*. **Mnium affine** var. **rugicum** (Laurar) Bryologia Europæa.

(*Astrophyllum rugicum* Lindberg).

(Plate XXII)

Darker green than true *affine*, almost blackish: stems short, usually simple; leaves oblong to broadly oval or sub-orbicular, the apex blunt and rounded with an apiculation or almost entire, the margin little or not at all serrate: capsule much as in *affine* var. *ciliare* but usually smaller. The leaves often very closely resemble those of *M. rostratum* but Grout says the leaf-cells have thinner walls in *rugicum* and also radiate in more or less definite series from the costa, while in *rostratum* the thick-walled cells are irregularly arranged, or at least not in radiating series.

In cool, shaded ravines and swamps; Europe, and, in North America, from Greenland to Alaska and locally south to Louisiana and Colorado.

Allegheny : Power's Run, April 18, 1906, and June 17, 1909, O. E. J.; Wildwood Hollow, March 29, 1908, and Coraopolis, September 14, 1905. O. E. J. and G. E. K. All sterile.

Beaver : Beaver Falls, May 11, 1907. O. E. J. Sterile.

Fayette : Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J. (Figured). Ohio Pyle, September 1-3, 1907. O. E. J. and G. K. J. (Both sterile.)

9. **Mnium stellare** [Reichenbach] Hedwig.
(Plate XXII)

Densely cespitose, soft, deep or bluish-green: stems erect, usually 1–3 cm. high, branching at base; leaves gradually larger above, elliptic-oblong, to suborbicular below, slightly decurrent, rounded and acute at apex to obtuse-apiculate, nonbordered, the upper part of the leaf obtusely irregularly short serrate; costa thin, ending considerably below the apex, smooth on back; leaf-cells incrassate, angular, irregular to hexagonal or subquadrate, fairly uniform in size, about .020–.030 mm.; seta solitary; capsule horizontal to inclined, oblong; lid conic-convex; peristome yellowish: dioicous; antheridial flower discoid: mature in summer.

At the base of trees or on rocks in swampy woods in temperate Europe, Asia, and North America, through lower Canada and northern United States. This species rarely fruits and all specimens from Pennsylvania thus far have been sterile.

Allegheny : Under side of rocks in crevices, Fern Hollow, Pittsburgh, March 9, 1908. O. E. J.

McKean : Rutherford Run, March 12, 1894, and Quintuple, September 9, 1894, and November 13, 1896. D. A. B.

Washington : North Branch of Maple Creek, above Charleroi, April 24, 1908. O. E. J. (Figured).

10. **Mnium punctatum** [Linnæus] Hedwig.
(Plate XXIII)

Rather large, dark green, erect, loosely tufted, 1–3 inches high: stems rigid, dark, densely tomentose nearly to the apex; dioicous; leaves remote, forming at the apex a rosette and largest there, spreading, the lower smaller, rounded-ovate, the terminal about 4–5×6–9 mm., broadly obovate, all narrowed to a few cells at the base, entire, apex usually apiculate, often somewhat emarginate-apiculate, bordered by a cartilaginous-thickened purplish-brown-pellucid rim of about 2–5 rows of elongate incrassate cells; costa strong, usually terminating or percurrent in the apiculus, or sometimes ceasing just below the apex; median cells rounded- to elongate-hexagonal, about .030–.040×.050–.085 mm., incrassate, the basal rather larger, rectangular, slightly inflated, the apical smaller, irregularly angular; seta 2–3 cm. long, erect, flexuous, purplish-brown, rather lustrous; capsule sub-pendulous, oval-oblong, yellowish to brown when old, finally when dry somewhat sulcate; operculum conic, acutely rostrate; peristome-teeth yellowish-brown, pellucid, papillose, trabeculate; segments nearly as high, brownish-pellucid, finely papillose, the basal membrane

reaching to one-third the height, cilia usually three, slightly shorter than segments; spores smoothish, round, about .028–.033 mm.; fruiting in spring rather early (April), and sometimes with two or three capsules to a plant.

On soil in damp woods, ravines, swamps, etc. Rather common. Europe, Asia, all North America down to middle United States.

Allegheny	: Schenley Park, Pittsburgh, June 7, 1904. O. E. J.; Wildwood Hollow, March 29, 1908. O. E. J. and G. K. J.
Elk	: McMinn. (Porter's Catalogue).
Huntingdon	: Porter. (Porter's Catalogue).
Lawrence	: Rock Point, October 15, 1910. O. E. J. and G. K. J.
McKean	: Gates Hollow, May 3, 1896. D. A. B.
Mercer	: Houston Junction, July 12, 1902. J. A. S.
Westmoreland	: Shades, above Blackburn, March 25, 1910. O. E. J. (Figured).

10*a*. **Mnium punctatum** var. **elatum** Schimper.

(Plate XXIII)

This variety differs typically from true *punctatum* in that it grows in muddy shaded places and swamps, is much larger,—in our specimens reaching a height of 7 or 8 cm. and with leaves up to 10 or 11 mm. long, the leaves are rounded and usually non-apiculate at apex, the border consisting of usually but one layer of cells, and the costa ending below the apex.

In swamps and muddy shaded places: Europe, Asia, and, in North America, from the Arctic regions south to Virginia, Michigan, and Idaho. In Pennsylvania most of the specimens of *punctatum* show some of the characters of the variety but we have found no specimen which clearly possesses all the characters attributed to the variety. The following specimens more or less closely approach the variety:

Allegheny	: Wildwood Hollow, November 19, 1908. O. E. J. and G. K. J.
Crawford	: Pymatuning Swamp, Linesville, June 11-12, 1907 O. E. J.
Fayette	: Ohio Pyle, July 4, 1908. O. E. J.
Lawrence	: Slippery Rock Creek, above Wurtemberg, October 16, 1910. O. E. J. and G. K. J.
McKean	: In overflow of cold spring, Railroad Run, May 21, 1899, in swamp along Foster Brook, May 22,1894. D. A. B.
Mercer	: Houston Junction, July 12, 1902. J. A. S. (Figured).
Westmoreland	: Shades, above Blackburn, March 25, 1910. O. E. J.

11. Mnium cinclidioides (Blytt) Huebener.
(Plate XXIII)

Large, loosely cespitose, bright green, becoming dark when old: stems rigid, under exceptional conditions reaching 15 or 20 cm. or more, our specimens sterile and about 4–8 cm. high, stems dark brownish; leaves remote, thin, large, the lower ones ovate to oblong and not at all decurrent, the upper rosulate, widely oblong-lingulate, rounded and obtuse with a minute apiculus, more or less undulate, up to 7 or 8 mm. long and 4 mm. wide in our specimens, margin non-bordered, entire with the exception of occasionally projecting marginal cells; costa ending considerably below the apex; leaf-cells rhomboid-hexagonal, arranged in series radiating from the costa, the marginal gradually becoming linear and parallel to the margin, all rather thin-walled, chlorophyllose, the largest up to about .030×.100 or .110 mm.: seta long, rather slender; capsule abruptly pendent, shortly oval; lid conic-apiculate; peristome brownish: dioicous: mature in summer.

In bogs, pools, and swamps in the cooler parts of Europe, Asia, and North America down to New Jersey and Pennsylvania; generally sterile.

Crawford : In Pymatuning Swamp, Linesville, June 12, 1905. O. E. J. (Figured). Sterile.

McKean : Sphagnum Swamp, West Branch, July 5, 1896, and July 22, 1894. D. A. B. Sterile.

Family XVI. *AULACOMNIACEAE.*

Dioicous, rarely autoicous: robust to slender, more or less high-cespitose: stem mostly with a central strand, with one to three innovations below the apex, also with slender sterile shoots from the older portions; leaves 8-seriate, gradually larger above, carinate or concave, ovate or oblong to lanceolate or lance-linear, acute to obtuse, non-bordered, mostly toothed above; costa mostly incomplete, with median guides; areolation small, rounded, incrassate, mostly papillose: sporogonia solitary; seta usually long, erect; capsule cernuous, rarely erect, oblong to cylindric, with a short collum, more or less 8-striate, plicate when dry; annulus present; exothecial cells elongate to rectangular, the longitudinal walls thickened; phanerophore, stomata in the collum only; peristomes free and essentially as in *Bryum;* spores .008-.014 mm.; operculum conic to rostrate; calyptra narrowly cucullate, long-rostrate, split on one side, fugacious.

Inhabiting the colder and temperate parts of the world, in moist habitats on soil, rocks, trees, etc. The genus *Leptotheca* with two species in the south temperate zone and the following:

1. *AULACOMNIUM* Schwaegrichen.

With characters as for the family, the stem sometimes bearing flagelliform pseudopodia, which are leafless or nearly so and bear a cluster of gemmæ at the tips; leaves crowded, erect-ascending, the margins more or less revolute; costa ending below apex; cells each with a central papilla; capsule somewhat arcuate; annulus 2–4-seriate, revoluble; teeth lance-linear and subulate-acuminate, yellow to rusty, the divisural zig-zag, finely papillose, with numerous articulations; inner peristome delicate, hyaline; segments lance-subulate, gaping; cilia well developed, delicate, mostly only weakly articulate; nine species widely distributed; five in North America, two in our range.

Key to the Species.

a. Autoicous; leaves strongly serrate from the middle upwards.
1. *A. heterostichum.*

a. Dioicous; leaves merely serrulate near the apex.
2. *A. palustre.*

1. **Aulacomnium heterostichum** (Hedwig) Bryologia Europæa.
(*Arrhenopterum heterostichum* Hedwig).

(Plate XXIV)

Rather loosely cespitose, pale to yellowish-green: stems branching by terminal, annual innovations, the annual growth in our specimens being usually about 8–10 mm., stems brown-radiculose below; leaves obovate below to oblong or oval above, often somewhat unsymmetrically inclined, the leaf plane above, repand denticulate in the upper half, mostly apiculate; costa strong, yellowish-brown, ending just below apex; leaf-cells incrassate, median and apical rounded-quadrate, about .008–.015 mm. in diameter, basal similar, quadrate to rectangular and 3:1; seta about 6–9 mm. long, erect, flexuous, reddish-brown, smooth, little or not at all twisted, capsule about 2.5 mm. long, oblong-cylindric, arcuate, inclined, reddish-brown, striate, when dry 8-plicate, tapering below into a short collum; annulate, doubly peristomate; teeth inserted on the capsule-rim, lanceolate, about 25–30-articulate, distinct to the base, yellowish-pellucid, rather indistinctly finely horizontally striate-papillate below, segments of same length or a little shorter, hyaline, more or less completely carinate-cleft in median portion, united in the lower third with the cilia into a basal membrane: cilia 3 (2), somewhat shorter, somewhat articulate; spores pellucid-yellowish, not distinctly papillose, about .012–.014 mm.; mature in May to June; operculum convex, obtusely short-rostrate; calyptra long-rostrate, cucullate.

On shaded, moist, earthy banks, bases of trees, etc., Japan and in North America from Ontario to Wisconsin, and Texas to Florida.

Fayette	: Ohio Pyle, J. A. S. June 15, 1902. (Figured); May 30-31, 1908. O. E. J.; September 1-3, 1906. O. E. J. and G. K. J.
McKean	: Gates Hollow, August 4, 1894. D. A. B.
Washington	: Linn and Simonton. (Porter's Catalogue).

2. **Aulacomnium palustre** [Linnæus] Schwaegrichen.

(*Mnium palustre* Linnæus).

(Plate XXIV)

Robust, densely cespitose mosses of bogs and moist places on soil or rotten wood; tufts often 2–3 inches deep, light yellowish-green above, below darker and stem covered with a reddish-brown tomentum; leaves oblong to linear-lanceolate, about 4 mm. long, minutely denticulate towards the apex, carinate, rather crispate when dry; costa strong, ending just below apex; upper cells small, round incrassate, unipapillate, basal cells elongate-rectangular or hexagonal, thin-walled: seta erect, tortuous, in ours about 3 cm. long, upper part dextrorse, lower part sinistrorse; capsule sub-cylindrical, 4–5 mm. long, when dry strongly sulcate, arcuate, constricted below mouth; annulus high, colored at the base; teeth lance-linear, subulate-acuminate, yellowish, trabeculæ sometimes united by oblique walls, divisural zigzag; segments delicate, slightly shorter, hyaline, cilia about 3, equally long, weakly articulate; spores small, smooth .008–.009 mm.; mature in early summer; operculum long-conic, often somewhat recurved.

Cosmopolitan. In swampy woods and bogs. In North America from the Arctic regions south to the Carolinas and California. Rather common in the northern part of our region.

Allegheny	: Coraopolis, August, 1905. O. E. J. and G. E. K.
Beaver	: In swamps near New Galilee, June 22, 1908. O. E. J.
Erie	: Presque Isle, May 8-9, 1906. O. E. J. (Figured).
Lawrence	: Swamp, north of New Castle, 1906. Susan Gageby.
McKean	: Quintuple, October 1, 1893, and Sphagnum Swamp, West Branch, Bradford, January 17, 1894. D. A. B.
Snyder	: Richfield, July 17, 1908. O. E. J.
Washington	: Linn and Simonton. (Porter's Catalogue).

Family XVII. *MEESEACEAE.*

Synoicous, autoicous, dioicous, or polyoicous: robust to slender, cespitose: stem with a central strand, elongate, leaves 3–8-seriate, moderately close, mostly from an erect base erect-spreading to recurved-squarrose, lance-ovate to lance-acuminate, non-bordered, sometimes toothed at the apex; costa strong, without guides, mostly incomplete; cells mostly parenchymatous and smooth, upper firm-walled, rectangular to rounded 4–6-sided, the basal often thin-walled, elongate-rectangular and hyaline: seta mostly long and slender, erect, tortuous; capsule erect, from a long collum elongate arcuate-pyriform, the mouth small and oblique, never constricted below the mouth; annulus small-celled, 1–2-seriate, loosening itself here and there, rarely persisting; teeth mostly much shorter than the segments, truncate, more or less completely confluent, with straight divisural and thin rectangular dorsal plates, the inner layer with low lamellæ; inner peristome with a carinate basal membrane united to the teeth; segments narrowly linear, alternating with the teeth, cilia rudimentary or none; spores .032–.056 mm., mostly finely granulate; operculum small, conic, obtuse; calyptra small, cucullate, smooth, fugacious.

A small family (3 genera) of mostly bog mosses of the cooler parts of the northern hemisphere. One genus represented in our range.

1. *MEESEA* Hedwig.

Characters mainly as for the family; the tufts green to yellowish-green, inside brown to blackish: leaves more or less decurrent, acute or obtuse, mostly entire; upper cells mostly rectangular, thick-walled, the lower elongate and hyaline: seta usually very long, inner peristome with a very low basal membrane; segments 2 to 4 times the length of the teeth, often more or less united at the tip; cilia short or rudimentary, often being represented by a chain-like series of thickenings on the persisting wall of the inner peristome.

Nine species in bogs and wet places; four species in North America; two species may be looked for in bogs and swamps in the northern part of our region.

Key to the Species.

a. Leaves three-ranked, serrate. 1. *M. triquetra.*
a. Leaves 5–8-ranked, entire. (*M. longiseta* Hedwig).

1. **Meesea triquetra** [Linnæus] Aongstroem.

(*M. tristicha* (Funck) Bryologia Europæa.)

Loosely cespitose, dark green: stems elongate, radiculose below, sparingly branching; leaves three-ranked, distant,

lanceolate, acute, strongly squarrose from a concave strongly decurrent half-clasping base, the spreading portion carinate, the margins sharply serrate; costa strong, ending in the apex or just below; upper leaf-cells rectangular to hexagonal, incrassate, the lower hyaline, elongate-rectangular; perichætial leaves larger, about six in number: seta long; capsule pyriform, curved from a long erect collum, when dry and empty more or less wrinkled and twisted; peristome-teeth 16, short, unequal, bifid; segments alternate, 16, about three times as long as teeth, united below into a low basal membrane, yellowish, linear, irregularly articulate and appendiculate; exothecial cells at mouth very small and in several rows, darker; lid convex-conic; spores large.

In bogs and swampy woods, Europe, Asia, and, in North America, from New Jersey, eastern Pennsylvania, Ohio and Lake Superior, north and west to Arctic America and the Pacific Ocean.

Family XVIII. *BARTRAMIACEAE.*

Dioicous or synoicous, rarely paroicous or autoicous: slender to very robust, cespitose: stems with central strand, erect, dichotomous or more often with whorled "sub-floral" innovations; leaves 5–8-seriate, little or not at all decurrent, lance-ovate to lance-subulate, non-bordered, serrate marginally above and often also on the back of the costa; costa mostly strong, with median guides, ending below or in the apex or excurrent in a serrate arista; cells parenchymatous, round-quadrate to elongate-rectangular, rarely linear, mostly thick-walled, mostly mamillate on both sides; basal cells either not wider, or lax, wider, and hyaline, mostly smooth, alar cells rarely differentiated: seta usually long and straight, little or not at all twisted when dry; capsule erect to cernuous, rarely pendent, more or less globose, darkly striate, collum rarely distinct, mouth oblique or rarely symmetrical, exothecial cells rectangular to hexagonal, several series at the mouth laterally elongate; annulus none or very incomplete; peristome mostly double or sometimes single or rudimentary, or lacking altogether; always inserted back from the exothecium by the width of several cells, peristome-teeth dagger-shape, golden brown to reddish-yellow, mostly non-bordered, inner peristome mostly shorter, carinate, the basal membrane one-fourth to one-half the height of the inner peristome; segments at first carinately gaping, then divergently parted, cilia 1–3, rarely well-developed, sometimes none, non-articulate; spore-sac very small; lid small, short-conic, rarely rostrate; calyptra small, cucullate, smooth, fugacious; spores large, round to oval or reniform, papillose.

A large family of eight genera; three genera in our region.

Key to the Genera.

a. Cilia well-developed: stem with a whorl of sub-floral shoots. 3. *Philonotis.*
a. Cilia poorly developed or none. b.
b. Leaf-cells mamillate or papillose; leaves 5-seriate or pluriseriate. 2. *Bartramia.*
b. Leaf-cells smooth; stem triangular and leaves 3-seriate. 1. *Plagiopus.*

1. *PLAGIOPUS* Bridel.

Synoicous: quite slender, laxly to densely cespitose, dull green, becoming brownish: stem erect or ascending, the outer layer of cells lax, hyaline, the central strand poorly defined, branching above the base, the shoots of about equal height; leaves spreading to recurved, somewhat twisted but not crispate when dry, from a non-sheathing base narrowly lanceolate, acuminate, sharply carinate above, the margin usually revolute, doubly serrate above; costa strong, percurrent, dorsally projecting and simply serrate upwards; leaf-cells incrassate, smooth, the upper minute, shortly rectangular and quadrate, basally more elongate and pellucid, the alar slightly more lax and quadrate: seta 1–1.5 cm. long, erect, castaneous, not twisted when dry; capsule erect, somewhat inclined when dry, globose, slightly arcuate, brown, finely striate, when dry somewhat shortened at the base and mouth, slightly curved and strongly plicate; peristome double, the teeth smooth, narrowly dagger-like, reddish-brown in the upper half, with interlamellar thickenings, the inner peristome shorter and pale yellow, cilia none; lid small, short-conic; spores mostly uniform, .024–.030 mm., warty.

A genus of three species: one in New Zealand, one in Java, and the following:

1. **Plagiopus oederi** [Gunnerus] Limpricht.

(*Bryum oederi* Gunnerus; *Bartramia oederi* Schwaegrichen; *Bartramia grandiflora* Schwaegrichen).

With characters essentially as given above for the genus. The spores mature in spring.

On moist soil and rocks in shady woods, mainly in non-calcareous and hilly or mountainous districts; Europe, Asia, and, in North America, from Canada to North Carolina and west to the Rocky Mountains. It may eventually be found in our region.

2. *BARTRAMIA* Hedwig.

Synoicous, paroicous, autoicous, or dioicous: slender to robust, laxly to densely cespitose, the tufts often blue-green above, brownish-yellow inside: stem with central strand rarely

lacking, erect, monopodial or dichotomous, branches not whorled; leaves mostly 8-seriate, from a mostly half-sheathing base gradually or abruptly subulate-linear, serrate upwards and often on the back of the costa; lamina upwards, sometimes only at the margin, two-layered; costa strong, projecting dorsally, incomplete to excurrent; leaf-cells small, incrassate, rectangular, mamillate on both sides, the basal elongate rectangular to linear, smooth, pellucid to hyaline: seta mostly 1–2 cm. long, rarely very short, mostly straight; capsule mostly inclined, somewhat arcuate, with mouth oblique, globose, no collum, when dry mostly sulcate, more or less shrunken in the middle and flattened on the ends; peristome double or single, rarely none, teeth not united at the apex, neither with interlamellar thickenings; cilia mostly none; lid small, inflated to short-conic.

A cosmopolitan genus of nearly 100 species, on earth or rocks in dry or moderately moist habitats; 13 species in North America; two species in our range.

Key to the Species.

a. Leaf-base neither sheathing nor conspicuously scarious, margin revolute. 1. *B. pomiformis.*

a. Leaf-base scarious and sheathing, margin plane. 2. *B. ithyphylla.*

1. **Bartramia pomiformis** Linnæus, p.p., Hedwig.

(Plate XXIV)

Rather densely cespitose, soft, yellowish-green: stems about 1.5–3 cm. long, erect, densely reddish-brown-felted below; leaves about 4–6 mm. long, the lance-subulate part spreading rather abruptly from a more or less erect and concave but scarcely sheathing lance-ovate base, the margin revolute in the basal half at least, serrate above, the costa rather narrow and distinct, excurrent in a spinulose-serrate subulation; basal leaf-cells smooth, hyaline, often reddish-brown and pellucid at insertion, elongate-rectangular, the marginal shorter in a few rows, median cells rounded-quadrate, incrassate, papillose: seta about 5–10 mm. long, erect or curved-ascending, smooth, reddish-brown; capsule globose, about 1.5 mm. in diameter, striate, unsymmetric, reddish-brown when ripe, globose to oblong or narrowly oblong, when dry deeply sulcate, cernuous, occasionally strumose, often somewhat arcuate; peristome double, teeth reddish-brown, narrowly triangular-lanceolate, faintly papillose, prominently articulate, sub-trabeculate, divisural faint, zigzag; segments two-thirds as long as teeth, carinately split, the cilia two or three and rudimentary, or none; lid convex, bluntly umbonate; calyptra narrowly cucullate, about 2 mm. long;

spores reddish-brown, pellucid, coarsely papillose, mature in May or June.

Cosmopolitan on rocks or soil in moist and shady woods; in North America from the Arctic regions to Alabama and Colorado. Common in our region.

Allegheny	: Flaugherty Run, Moon Township, February 26, 1887. J. A. S.; Thornhill, December 29, 1908. O. E. J.; Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J.
Crawford	: On clayey roadside-bank, Hartstown, May 29-31, 1909. O. E. J. and G. K. J. (Figured).
Elk	: Dent's Run, July 19, 1904. O. E. J.
Fayette	: On rock in woods, Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
McKean	: Toad Hollow, Bradford, July 19, 1896. D. A. B.
Washington	: Valley of Maple Creek, Charleroi, October 13, 1905. O. E. J. and G. E. K.

1*a*. **Bartramia pomiformis** variety **crispa** (Swartz) Bryologia Europæa.

This variety is taller and looser than the species: leaves longer, more distant, when dry more crispate; the innovations are long, often longer than the seta.

In moister or more shaded situations but with much the same general distribution as the species.

McKean : D. A. B. (Porter's Catalogue).

2. **Bartramia ithyphylla** [Haller] Hedwig.

Densely cespitose, silky, glaucous-green or yellowish: leaves close, rigidly divergent from a white, scarious, erect-appressed glossy base, when dry quite straight and more or less erect, the spreading lamina linear-subulate, abruptly contracted from the obovate base, margin plane, sharply denticulate above; costa strong but not very distinct above, excurrent into the denticulate subulation; basal leaf-cells linear, 4–10:1, hyaline, the median and upper papillose, obscure, about 3–6:1: seta long; capsule similar to that of *B. pomiformis,* globose-oblong, when dry curved and deeply furrowed; peristome-teeth reddish-brown, apically bifid or irregularly perforate; segments yellowish, cleft, much shorter than the teeth: synoicous: spores mature in summer.

On moist earth or in moist fissures of rocks, mainly in alpine regions, in Europe, Asia, and in Arctic and temperate North America. Rare in our region.

Fayette : Layton's, Rev. S. W. Knipe. (Porter's Catalogue), and Knight. (Lesquereux and James).

3. *PHILONOTIS* Bridel.

Dioicous, rarely autoicous: very slender to robust, cespitose, bright green to yellowish-green or bluish-green: stem with a distinct central strand, erect, more or less elongate, usually with whorled sub-floral shoots; leaves erect-spreading to secund, uniform or dimorphic, lance-ovate, mostly acute, dentate or serrate, mostly with lamina one-layered; costa percurrent to excurrent, rarely incomplete, cells of the apex elongate to shortly rectangular, sometimes rhomboidal, rarely parenchymatous and 5–6-sided, mostly ventrally or on both sides mamillate, rarely so only dorsally, or rarely smooth, basal cells more lax: sporogonia solitary, seta erect, long; capsule inclined to horizontal, globose, unsymmetric. with mostly short collum, striate, when dry sulcate and mostly constricted in the middle, rarely drying erect and smooth; peristome mostly double, the inner one rarely lacking; teeth generally with interlamellar thickenings; lid mostly low-convex to short conic.

A large and cosmopolitan genus of 211 species, on earth and rock in swamps and springy places; about 30 species in North America; three species in our region.

Key to the Species.

a. Perigonial bracts obtuse, widely spreading from an erect base; median leaf-cells about .006–.010 mm. wide; leaves dimorphic: cilia well-developed. 3. *P. fontana.*

a. Perigonial bracts acute. b.

b. Leaves not dimorphic, not or scarcely plicate; perigonial bracts long-acuminate: cilia rudimentary. 1. *P. muhlenbergii.*

b. Leaves dimorphic, those of stems of archegonial plants somewhat plicate; perigonial leaves long-acuminate with excurrent costa. 2. *P. calcarea.*

1. **Philonotis muhlenbergii** (Schwaegrichen) Bridel.

(*P. marchica* Sullivant).

(Plate XXIV)

Rather densely cespitose, light yellowish to bluish-green: branches reddish, whorled from below the archegonial clusters, erect to ascending, reddish-tomentose below, about 1–3 cm. high, slender; leaves of fertile stems 1–1.5 mm. long, rather distant, lance-ovate, acute, ascending to appressed, when dry somewhat crispate, carinate, with revolute margins but not plicate, more or less spreading, serrulate in apical half, scarcely decurrent; costa strong, brownish, percurrent; leaf-cells mostly parenchymatous, rectangular to hexagonal, incrassate,

median cells strongly papillose on upper end, about .003–.006× .015–.030 mm., elongate-rectangular, apical cells narrower and tending to vermicular-hexagonal, basal cells looser, more or less rectangular, up to .012×.040–.060 mm., smooth; inner perichætial leaves ovate-triangular at base with the costa excurrent into a subulate apex, the margin entire, the cells rather lax; perigonial leaves erect-spreading, long-acuminate: seta about 2.5–3 cm. long, erect, smooth, shining, reddish-brown, when dry flexuous; capsule globose to ovoid-globose, faintly striate, about 2–2.5 mm. in diameter, brownish, when dry sulcate and variously wrinkled, arcuate, cernuous, the neck sunken in, about 4–6 rows of cells at the mouth of the capsule laterally elongate; peristome double, the teeth 16, narrowly triangular-lanceolate, prominently articulate, pellucid, orange to reddish-brown, divisural zigzag, distinct below; segments narrow, about four-fifths as high as the teeth, mostly split apart; cilia three, very short, the basal membrane comprising more than half the height of the inner peristome, the segments and the upper part of the membrane orange-pellucid, papillose-striate; spores globose, papillose, pellucid, orange to reddish-brown, .018–.020 mm., mature in June.

On dripping rocks along streams, wet places, etc., from Massachusetts to Pennsylvania and westward to Kansas and Washington. Uncommon in our region.

Allegheny : In crevices of rocky bed of stream, ravine of Power's Run, May 14, 1908. O. E. J. (Figured).

Lawrence : Wet rocks in deep ravine near Rock Point, June 26, 1909. O. E. J.

2. **Philonotis calcarea** (Bryologia Europæa) Schimper.

(Plate XXV)

Densely and softly cespitose, bright green, more or less glaucous above, brownish below: stems long, up to 10–12 cm., slender, erect in the dense tufts, red-brown and densely felted-tomentose below; branches in whorls; leaves dimorphic, stem-leaves broadly ovate, acuminate, about 1.5 mm. long by 1 mm. wide, deeply concave, plicate, towards the apex sharply serrulate, towards the base the basal papillæ of the cells forming rounded projections, especially on the revolute margins, the margins revolute narrowly towards the clasping and sub-decurrent base, the leaves erect-spreading to secund when moist, shrunken and sub-crispate when dry; branch-leaves when moist usually more or less falcate-secund, lanceolate and narrowly acuminate, about 1–1.5 mm. long, by 0.5 mm. wide, when dry somewhat shrunken and twisted; costa in both forms of leaves strong, ending in apex, dorsally papillose, basal leaf-

cells rather thin-walled, rectangular, up to .060–.080×.015–.018 mm., pale, pellucid, towards the margins and upwards becoming shorter, more incrassate, papillose at the ends, the median and upper leaf-cells becoming quadrate to 2–4 times as wide as long, strongly papillose at their upper ends, incrassate, pellucid: capsule not seen but said to be large and similar to that of *P. fontana*: perigonial leaves widely ovate and linear-acuminate: spores mature in summer, but the capsules rather rarely produced. In vegetative characters this species is difficult to differentiate from forms of *P. fontana* or from *P. seriata.*

In calcareous bogs and springs, Europe, Asia, Algeria, and, in North America, from New England to Pennsylvania and Nevada. Uncommon in our region.

Clinton : In roadside ditch, north of Renovo, July 15, 1908. O. E. J. (Figured).

Huntingdon : Warrior's Ridge, T. C. Porter. (Porter's Catalogue).

3. **Philonotis fontana** [Linnæus] Bridel.

(*Mnium fontanum* Linnæus; *Bartramia fontana* Swartz).

(Plate XXV)

Cespitose, yellowish-green, sometimes quite glaucous, loose above but interwoven below with a reddish-brown felt-like tomentum: stems erect, reddish, slender, usually 2–6 cm. high, densely fulvous-radiculose below, the innovations usually whorled and giving the plants the appearance of being pleurocarpous; leaves about 1.5–2 mm. long, lance-ovate, acuminate, appressed when dry, usually quite plicate on each side of the costa near the base, serrate above, usually more or less revolute towards the base; costa strong, often percurrent or even excurrent; basal cells elongate-rectangular to elongate-hexagonal, loose, pale pellucid, about .008–.012(–.015) mm. wide, the end-walls often papillose, the cells in the acumen linear-vermicular, incrassate and more or less papillose at both ends; perigonial leaves spreading, broadly triangular-ovate, the inner often obtuse and rounded at the apex, the costa not reaching the apex: seta dark red, 2–4.5 cm. long; capsule ovate-globose, large, brownish, thick-walled, striate, oblong, when dry and empty arcuate and irregularly ribbed; operculum conic-convex, acute; peristome-teeth reddish-brown, pellucid, lanceolate; peristome-segments nearly as long as teeth, narrow, carinately gaping, cilia three (two) about as long as segments; spores very slightly papillose, incrassate, yellowish-brown, about .019–.023 mm., usually mature in June.

Water-loving mosses usually avoiding calareous habitats, on dripping rocks or in swamps and wet places. Cosmopolitan and occurring in North America throughout, from Canada to

Florida, in the cooler portions. Common but only occasionally fruiting in our region.

Allegheny : Flood-plain of Brush Creek, Douthett, April 26, 1908. O. E. J. and G. K. J. (Figured).

Armstrong : Face of dripping sandstone cliff, West Winfield, June 20, 1904. O. E. J.

Center : Matternville Gap, Bald Eagle Mt., July 15, 1909. O. E. J.

Clinton : Flood-plain of Hyner Run, July 14, 1908. O. E. J.

Fayette : In crevices of rocky river-bed, Ohio Pyle, September 1-3, 1906. O. E. J.

Huntingdon : Roadside-ditch, Huntingdon, July 20, 1908. O. E. J.

Indiana : Along Cush-Cushing Creek, near Grant, July 12, 1908. O. E. J.

Lycoming : Swampy flood-plain near Williamsport, July 16, 1908. O. E. J.

McKean : Bradford, April 14, 1893, July 4, 1895, May 23 and July 7, 1897, and Quintuple, June 9, 1897. D. A. B.

Westmoreland: Greensburg, May 27, 1893. Miss Katherine Holmes.

3a. **Philonotis fontana** variety **falcata** Bridel.

Leaves falcate-secund; branches hooked towards the apex.

Center : Matternville Gap, Bald Eagle Mt., July 15, 1909. O. E. J.

Family XIX. *TIMMIACEAE.*

Dioicous or autoicous; robust, in more or less high, lax, dull-green to yellowish-green tufts, brownish inside, with a brown tomentum below: stem erect or procumbent, with central strand, densely-leaved, simple or dichotomous; leaves 8-seriate, of uniform length, from a half-sheathing, non-decurrent base spreading to recurved, elongate lance-linear, carinate; lamina unistratose, channeled to concave, non-bordered, serrate; costa strong, percurrent, often dorsally toothed above, with several median guides; leaf-cells green, small, rounded to 4–6-sided, ventrally mamillate; cells of the sheathing part without chlorophyll, sometimes dorsally papillose, elongate-rectangular to linear, narrow towards the margin: sporogonia solitary; seta long, erect; capsule cernuous to almost pendent, from a short collum oblong-oval, brown, not or but slightly striate, when dry ribbed; annulus revoluble; peristome inserted back from the edge of the mouth, always double, the inner as long as the outer, when dry the parts sharply bulged outwards in the middle; teeth confluent at the base, broadly

lance-linear, rarely split, plane, below yellowish and transversely striate-punctate, above whitish and vertically papillose-striate, divisural zigzag, dorsal plates low, sometimes cut by cross-walls; inner peristome free, yellow, basal membrane high, carinate, transversely striate, dividing into 64 filiform, papillose cilia, united apically into groups of fours, generally appendiculate on the inner side; spores .012–.023 mm., yellow, almost smooth; operculum hemispheric, often apiculate; calyptra cucullate, long and narrow, often remaining on the seta.

One genus with characters as for the family; 10 species; three in North America, one in our range.

1. *TIMMIA* Hedwig.

1. Timmia cucullata Richard.

(*T. megapolitana* American authors, in part).

(Plate XXV)

Loosely cespitose, bright green above, brownish below: stems erect, sparingly branched, radiculose below; leaves lanceolate to lance-linear, spreading from a concave appressed and more or less sheathing base, acute to subacute, the margins serrate almost to the sheathing base, the spreading portion of the leaf concave, smooth on back or more or less involute; costa rather narrow, strong, ending in the apex; basal leaf-cells elongate-rectangular, rather thin-walled, hyaline, hardly inflated, in upper part of sheathing base becoming shorter to quadrate, and incrassate, the outer walls bulging so as to appear slightly papillose, about .010 mm. in diameter: seta about 2 cm. long, erect; capsule inclined to cernuous, oblong, when dry and empty unsymmetric, strongly curved, and somewhat wrinkled and tapering gradually from the wide mouth to the seta; lid rounded and apiculate; annulus revoluble, pluriseriate; peristome double, the teeth 16, lance-linear, yellowish-pellucid, trabeculate on inner side, articulate and with a divisural on outer surface, inner peristome with high basal membrane and 64 filiform cilia united into groups of four each, opposite to and about as long as teeth; calyptra cucullate; spores smoothish, mature usually in May.

In shade, on moist banks, or bases of trees, mostly in calcareous districts; Europe, and, in North America, from Newfoundland to Pennsylvania and west to the Pacific States. Rarely collected in our region.

McKean : Riverside swamp, ten miles north of Bradford, on base of old elm, August 19, 1896. D. A. B. Sterile. (Figured).

Family XX. *BUXBAUMIACEAE.*

Autoicous or dioicous: perennial, low, gregarious to laxly cespitose, dark green, finally brownish: protonema more or less

persistent; stem without central strand, mostly very short, erect, thickly foliate to almost leafless: seta ranging from almost none up to 5–20 cm. long, erect; capsule proportionally large, sub-erect to inclined, often finally more or less horizontal, dorsiventrally unsymmetric, flattened above, ovate to oblong or ovate-conic, narrowed to a very small mouth; annulate; peristome double or, apparently, single, the inner consisting of a membraneous plaited cone with an apical opening, the teeth originating from one to four concentric rows of cells, faintly barred; operculum conic, glabrous, smooth; spores very small.

A very small and rather primitive family of mosses, growing on earth or decayed wood. Two genera, as follows:

Key to the Genera.

a. Seta almost none; capsule immersed in the fringe of the perichætial leaves. 1. *Diphyscium.*

a. Seta 5–20 cm. long, thick, red or reddish-brown; leaves none at the time of ripening. 2. *Buxbaumia.*

1. *DIPHYSCIUM* [Ehrhart] Mohr.

(*Webera* Ehrhart, not Hedwig).

Autoicous or dioicous: perennial, mostly low and densely gregarious; protonema long-persisting; stem without central strand, short, erect, radiculose, thickly-leaved, simple, rarely longer and branched; leaves twisted or crispate when dry, spreading when moist, the lower lingulate or elongate-spatulate, obtuse or acuminate, entire; costa strong, without guides, ending below apex; lamina 2–(3–) stratose; leaf-cells on both sides mamillate to smooth, rounded to 4–6 sided, incrassate, often widened transversely, in the basal portion uni-stratose, pellucid to hyaline, lax, elongate 4–6-sided with the transverse walls incrassate, smooth; perichætial leaves much larger, erect, membranaceous, elongate, lanceolate to linear, the apex usually fringed and the costa long aristate-excurrent: seta very short, without central strand; capsule immersed, obliquely ovate-conic, gibbous, without collum, mouth very small; annulus present; outer peristome rudimentary or none, when present consisting of 16 triangular teeth; inner peristome pale, membranaceous, 16-plaited, papillose, short-conic; operculum small, acute-conic, falling away attached to the upper part of the fleshy columella; calyptra very small, conic, glabrous.

A genus of 10 species, only one in North America.

1. **Diphyscium foliosum** [Weber] Mohr.

(*Buxbaumia foliosa* Weber; *Webera sessilis* Lindberg).

(Plate XXV)

Small, widely cespitose, very short-stemmed (1–2 mm.), the general appearance being that of a grain of wheat sitting in a tuft of bristles: stem-leaves minute, the largest being

about 3 mm. long, linear-oblong, obtuse, somewhat concave, crisped when dry; costa broad, nearly reaching apex; perichætial leaves 4–7 mm. long, lance-linear, the costa one-third the width of the leaf at base, brownish-yellow, excurrent as a spinulose arista which often reaches one-half the whole length of the leaf, the apex of the lamina acute and entire or incised; cells at base of the stem-leaves and of nearly the whole lamina of the perichætial leaves hyaline, thin-walled, irregularly elongate-rectangular to hexagonal, the costa in the lamina of the perichætial leaves being bordered on either side by several rows of smaller, chlorophyllose, quadrate, and somewhat opaque cells, the lamina of the stem-leaves also being opaque with very small round-hexagonal cells: capsule 4–6 mm. high, ventricose, ovate-conic, yellowish-green; operculum acute-conic; calyptra small but covering the operculum; annulus and outer peristome more or less rudimentary; inner peristome conic, whitish, membranaceous, papillose, 16-carinate; spores moderately thick-walled, .007–.010, papillose, mature from midsummer to early fall.

On moist, shaded banks, earthy hillsides, etc. Widely distributed in the Northern Hemisphere. In North America from Nova Scotia to Ontario, south to Alabama. Not uncommon among the mountains and hills of our region.

Center : Tussey's Mt., Shingletown, July 15, 1909. O. E. J.

Fayette : Along wooded roadside bank, slope of Sugar Loaf Mt., September 1-3, 1906, (Figured), near Lovers' Leap, Ohio Pyle, September 4, 1906. O. E. J. and G. K. J.; Ohio Pyle, May 30, 1908. O. E. J.

Westmoreland: Roadside bank, "Rachelwood," New Florence, altitude 2,100 ft., September 8-10, 1907. O. E. J.

2. *BUXBAUMIA* Haller, Hedwig.

Dioicous; antheridial plants microscopic on the green protonema; archegonial plants with a short stem, a few small leaves, and one or two archegonia but no paraphyses: isolated or gregarious, annual: stem barely 1 mm. high, simple, with hyaline rhizoids; leaves ovate to lance-ovate, the basal portion green and its cells growing out into long brown filaments during the development of the sporogonia, finally covering the stem and vaginule with a thick tomentum; leaf-cells lax, long-hexagonal; perichætial and upper leaves soon disappearing: seta 5–20 mm. long, thick, red-brown, warty, the central strand being surrounded by an air-space; capsule obliquely ascending, the upper surface flattened, the urn brownish and with a

short erect collum and narrowed above to a very small mouth; a low pseud-annulus present consisting of a number of layers of cells; outer peristome of one to several rows of short and irregular teeth; inner peristome a pale, plaited, membraneous, truncated cone, as in *Diphyscium*, 32-carinate; spore-sac small, surrounded by a large air-space; spores small; operculum small, conic-obtuse, erect, falling tardily with the upper part of the columella attached; calyptra small, covering only the operculum, glabrous, fugacious.

A rather widely distributed genus of 5 species, 3 of which occur in North America, one in our region.

1. **Buxbaumia aphylla** Linnæus, Hedwig.

(Plate XXVI)

Plants minute on a thick, brownish, felted protonema and after the development of the sporophyte usually completely obscured by a dense growth of protonemal filaments: seta erect, stout, rough, about 1 cm. high, castaneous; capsule when ripe, lustrous, castaneous, ovate-acuminate in outline, flattened obliquely in the upper two-thirds, with angular edges, smoothish, about 5–7 mm. long; operculum about 1.5 mm. high, oblong-conic, disproportionately small; calyptra falling early, conic, covering only about one-half the operculum; peristome consisting of an outer series of papillose short, slender teeth, and a longer, papillose, conical, plaited cone; spores smooth, spherical, about .007 mm. in diameter, mature in late fall and early spring.

On clayey and mud-covered banks in woods; Europe, Asia, and, in North America, from Canada to West Virginia and Washington State. Rather rare in our region.

Cameron : D. A. B. (Porter's Catalogue).

Lawrence : On clay bank with decayed wood, under hemlocks and beeches, ravine three miles north of Wurtemberg, October 16, 1910. G. K. J. (Figured).

Huntingdon : Boecking. (Porter's Catalogue).

Family XXI. *GEORGIACEAE.*

Autoicous: slender to very small, dull, gregarious to cespitose, bright to brownish-green: stem erect, leaves 3–5-seriate, unistratose, costa obscure to well-developed and ending just below the apex; cells parenchymatous, thick-walled, smooth; perichætial leaves larger: seta long, erect, straight or geniculate in the middle; sinistrorse below, dextrorse above; capsule erect, symmetric, smooth, oval or cylindric; annulate; peristome inserted below the mouth, consisting of the entire mass of tissue enclosed within the operculum, this splitting by two

planes vertically into four solid, three-angled, elongate-pyramidal teeth; columella reaching only to the level of the mouth; spores .008–.015 mm., smooth; operculum conic, unistratose, cleft on one side; calyptra conic, glabrous, plicate, the margin lobed.

A very small family of 5 species, occurring on rocks, rotten wood, soil, etc., in Europe, Asia, and North America. Two genera; *Tetradontium* and the following:

1. *TETRAPHIS* Hedwig.

(*Georgia* Ehrhart).

Slender plants, more or less densely cespitose in wide soft tufts, bright green to brownish, radiculose-tomentose below: stems to 3 cm. long, with central strand, three-angled, branched, with distant, scale-like, ecostate leaves below; upper stem-leaves abruptly larger, approximate, ovate-lanceolate, acute, margins plane and entire; costa ending below, or in the apex, 4–5-stratose at base, cells incrassate, uniform; leaf-cells incrassate, round-hexagonal, wider transversely, elongate in the leaf-apex, rectangular at the leaf-base: seta 1–1.5 cm. long, often two together; capsule erect, symmetric, greenish, when empty brownish and weakly dextrorse, without stomata; calyptra enclosing the upper one-third of the urn, its apex carinate-toothed; gemmæ lenticular, borne in a cup formed of four or five broadly cordate bracts at the apex of the more slender and flexuous gemmiferous stems.

Four species, all occurring in North America, only the following one in our range:

1. **Tetraphis pellucida** [Linnæus] Hedwig.

(*Georgia pellucida* Rabenhorst).

(Plate XXVI)

Loosely cespitose in wide yellowish-green tufts: stems erect, about 1 cm. high, densely felted-radiculose at the base, reddish below; basal-leaves minute, upper leaves larger, tufted, ovate-lanceolate, margin entire; certain stems bearing at the apex gemmæ-cups about 1 mm. in diameter, the surrounding leaves being broadly obovate to reniform, truncate or apiculate at the apex; perichætial leaves linear-lanceolate, up to 4.5 mm. long; costa of stem leaves wide, ending below apex, in perichætial leaves often percurrent; areolation dense, rounded, the cells of the perichætial leaves irregularly elongate at base; the cups enclosing small, many-celled, lenticular gemmæ: seta yellowish to reddish, erect, dextrorse above, about 1–1.5 cm. long; capsule cylindric-lanceolate, erect to ascending, reddish, about 2–2.5 mm. long; annulus none; peristome consisting of 4 linear-triangular thick teeth, reddish to brownish, compris-

ing about one-fifth of the length of the capsule; operculum lustrous, conic, acute; calyptra whitish and lacerate below, plicate, enclosing the whole capsule, at apex solid, acute, rough; spores about .010 mm., thin-walled, slightly papillose, mature in summer or early fall; capsules persistent.

Widely distributed, on peaty soil, decayed logs, etc., Europe, Asia, and, in North America, in Canada and northern United States. Common in our range.

Allegheny : Rotten log, Fern Hollow, Pittsburgh, November 9, 1909. E. M. Gress.

Center : Barrens, near Scotia, September 22, 1909 O. E. J.

Crawford : Pymatuning Swamp, Linesville, May 10-11, 1906, Hartstown, August 4, 1909. O. E. J.; Hartstown, May 29-31, 1909. O. E. J. and G. K. J.

Lawrence : Rock Point, Gorge of Conoquenessing, October 15, 1910. O. E. J. and G. K. J.

McKean : West Branch, Bradford, June 4, 1896, and Langmade Hollow, Bradford, October 11, 1897. D. A. B.

Westmoreland: Mellon's Estate ("Rachelwood") New Florence, September 8-11, 1907. O. E. J. (Figured).

Family XXII. *POLYTRICHACEAE.*

Dioicous, rarely paroicous or synoicous; antheridial flower terminal, large, discoid, generally bearing a shoot in its middle; archegonial flowers terminal, bud-like; perennial, mostly very large, mostly cespitose, with a long horizontal, subterranean, triangular, blackish, branched, radiculose rhizome; stem erect with lower leaves none or remote, leaves weakly costate, three-seriate, without lamellæ, red to hyaline, small and scale-like; upper part of stem five-more-angled, with specialized central strand; stem structure complex; upper leaves larger, the sheathing base usually yellowish to hyaline, lamina more or less spreading or recurved, when dry mostly erect, sometimes convolute to crispate, mostly lanceolate to lance-subulate, sometimes lingulate, mostly sharply toothed, mostly plane with erect edges, uni-stratose or with two-stratose zone next the costa, rarely two-stratose to the margin, with narrow, vertical, green, longitudinal, mostly uni-stratose lamellæ on the ventral surface of the costa and of the bi-stratose lamina; costa strong, wide, incomplete to aristate-excurrent, dorsally often toothed and rarely lamellate, complex in structure; leaf-cells parenchymatous, small, the basal rectangular to linear and narrower towards the margin; seta elongate, mostly solitary, often flattened and weakly sinistrorse; capsule first erect, later

inclined to horizontal or pendent, cylindric to prismatically 4–6-sided or cubic, collum various; annulus none or uniseriate with three or four transitional bordering cells; peristome rarely lacking, mostly simple with 32 to 64, rarely 16, lingulate, short, unbarred teeth, triangular in cross-section, rising from a basal membrane, the teeth hyaline, often with a colored median line, incurved to meet the disk-like apex (epiphragm) of the columella; spores mostly small, .008–.012 or .014–.021 mm., mostly smooth; operculum apiculate to rostrate from a conic to convex base; calyptra cucullate, rarely glabrous, mostly spinulose to long, villous and felted.

A cosmopolitan family, mostly on siliceous or other non-calcareous soils; in colder regions often forming large masses of vegetation.

Key to the Genera.

a. Capsules cylindric. b.
a. Capsules four-angled or six-angled. 3. *Polytrichum.*
b. Leaves not crisped when dry; calyptra hairy. 2. *Pogonatum.*
b. Leaves crisped when dry; calyptra not hairy. 1. *Catharinaea.*

1. *CATHARINAEA* Ehrhart, Weber and Mohr.

(*Atrichum* Beauvois).

Stems of moderate height, in loose tufts or gregarious, dark green to bronze when old, central strand generally well developed; rhizome creeping, branched, bearing loosely- to thickly-leaved erect shoots, densely radiculose at the base; leaves lingulate to ovate-oblong, not sheathing nor narrowed above the base but slightly embracing the stem, margined, serrate; crisped when dry, costa narrow, on the upper side with 1–12 narrow lamellæ, ending below or in the apex, towards the apex often spinose-serrate; cells chlorophyllose, the upper rounded-hexagonal, smooth, the basal mostly rectangular: seta long, erect; capsule smooth, cylindric to oval, rarely obovate, often more or less curved; operculum long-rostrate; peristome of 32 teeth with pale borders and a median orange to reddish-brown line, the basal membrane narrow and reddish-brown or orange; calyptra smooth, except at the apex, where it is spinulose-papillose: mostly dioicous.

A cosmopolitan genus comprising about 43 species, growing on earth, mostly in the temperate zones; 19 species in North America; four species in our region.

Key to the Species.

a. Upper leaf-cells .015 to .025 mm., in diameter; costa and lamellæ not exceeding one-third of the width of the upper half of leaf. b.

a. Upper leaf-cells .007 to .015 mm. in diameter; costa and lamellæ extending over one-fourth to three-fifths of the width of upper half of leaf. c.
b. Lamellæ 3–6 in number and 3–6 cells in height, covering about ⅛ to ¼ of the upper leaf-width.
1. *C. undulata.*
b. Lamellæ 5–7 in number and 4–7 cells in height, covering about ⅙ to ⅓ of the upper leaf-width.
1*a*. *C. undulata* var. *allegheniensis.*
c. Lamellæ 5–8, 6–8 cells high, covering ¼ to ½ of upper leaf-width. 2. *C. angustata.*
c. Lamellæ 6–8, 8–14 cells high, covering about ½ to ⅔ of upper leaf-width. 3. *C. papillosa.*
c. Lamellæ 7–12, 8–14 cells high, covering about ⅔ to ⅘ of upper leaf-width. 4. *C. plurilamellata.*

1. **Catharinaea undulata** [Linnæus] Weber and Mohr.
(*Bryum undulatum* Linnæus; *Atrichum undulatum* Beauvois).

(Plate XXVI)

Loosely cespitose, dull, dark green: stems erect, ranging from 1.5–6 cm. long, usually about 3–4 cm., mostly simple, more or less gray-radiculose below, arising from a rhizone-like base; lower leaves minute, increasing in size upwards, the upper leaves lanceolate-lingulate, much crisped when dry, transversely undulate when moist, sub-acute to obtuse, about 6–8 mm. long, 1 mm. wide, serrulate to the middle or slightly below, the uppermost teeth double, strong, being inserted in a border of 1–3 rows of brownish, pellucid to hyaline, incrassate, narrow cells; the crests of the undulations on the back of the leaf also often spinose in upper part of the leaf; leaf-cells elongate-rectangular at base, reaching about .017×.033 mm., becoming quadrate towards leaf-middle, towards apex hexagonal and somewhat longer transversely and about .017–.024 mm.; costa strong, ending just below apex, sharply dorsally toothed, ventrally with 3–6 longitudinal lamellæ which each consist of 3–6 rows of cells similar to those of the leaf-blade, the costa and its lamellæ covering rarely more than one-fourth of the total leaf-width (in our region sometimes even narrower): seta erect, flexuose, somewhat sinistrorse, smooth, lustrous castaneous, 2–5 cm. long; capsule lustrous, becoming dull with age, castaneous, cylindrical, arcuate to almost straight, inclined, smooth, about 4–5×1–1.3 mm.; peristome single, the 32 teeth linear-lanceolate, obtuse, about 0.3 mm. high, orange-pellucid along the median line, united in the lower third into a reddish-orange basal membrane, the teeth covered (especially along the margins) with a hyaline, densely but minutely papillose layer which, during the winter, becomes deciduous, thus leaving the teeth perfectly smooth; spores smooth, orange, spherical, about .016–.019 mm. in diameter; mature in late fall, operculum conic, curved linear-rostrate,

about 2.5–3 mm. long; calyptra pale, roughened towards apex, covering about one-half to one-third of urn.

Widely distributed throughout the North Temperate Zone on earth, particularly partly shaded clay banks. Common in our region.

Allegheny	: Power's Run, September 21, 1905, Schenley Park, October 30, 1905, and Darlington Hollow, October 12, 1908. O. E. J.; Wildwood Road, March 29, 1907. O. E. J. and G. K. J.
Clinton	: Hyner Creek, above Hyner, July 15, 1908. (Figured). O. E. J.
Crawford	: Linesville, May 10-11, 1906. O. E. J.
Elk	: Head of Little Mill Creek, March 31, 1910. A. B. Wallgren.
Fayette	: Ohio Pyle, May 13, 1905. O. E. J.; September 1-3, 1907. O. E. J. and G. K. J.
McKean	: Langmade, May 29, 1898. D. A. B.

1*a*. **Catharinaea undulata** variety **minor** Weber and Mohr. (Plate XXVII)

Differs from the species in having the stem, leaves and sub-erect capsule shorter.

Erie	: Presque Isle, May 8-9, 1906. O. E. J. (Figured).
Fayette	: Ohio Pyle, May 30-31, 1908. O. E. J.

1*b*. **Catharinaea undulata** variety **allegheniensis** New Variety. (Plate XXVI)

Similar to the species in general habit and appearance but usually somewhat smaller and more slender: the lamellæ 5–7 in number, usually 6, ranging from 4–7, usually 6, cells in height, the costa and lamellæ together occupying from one-sixth to one-third of the width of the upper part of the leaf; the upper leaf-cells about .016–.018 mm. in diameter.

This variety is much more abundant in the Pittsburgh district than is the species, evidently preferring habitats with shales and sandstones such as those of the Carboniferous.

Allegheny	: From sixteen different collections of various dates and localities, the type collection being Powers Run, Montrose, April 18, 1906. O. E. J. (Figured). (Deposited in the Pennsylvania Herbarium of the Carnegie Museum.)
Armstrong	: Kittanning, September 24, 1904, and September 27, 1909. O. E. J.
Beaver	: Beaver Falls, May 11, 1907. O. E. J.
Crawford	: Linesville, May 12, 1908. O. E. J.

Fayette : September 10, 1905. O. E. J. and G. E. K.; September 1-3, 1907. O. E. J. and G. K. J.

Washington : Charleroi, October 14, 1905. O. E. J. and G. K. J.

Westmoreland: New Florence, September 8-11, 1907, and "Shades," east of Blackburn, June 13, 1908. O. E. J.

2. **Catharinaea angustata** [Bridel] Bridel.

(*Polytrichum angustatum* Schwaegrichen; *Atrichum angustatum* Bryologia Europæa).

(Plate XXVII)

Loosely cespitose: stems erect, about 1–3 cm. high, or more; lower leaves minute, the size of leaves increasing upwards, dull green, much crisped when dry, lance-linear, doubly serrate from about the middle upwards along the margin and dorsally towards the apex; costa with about 5–8 ventral lamellæ above, the costa and lamellæ together occupying about one-fourth to one-half of the width of the leaf; lamellæ 6–8 cells high, cells equal in size; basal leaf-cells elongate-rectangular, rather incrassate, about .010–.025 mm. in diameter, above becoming quadrate, towards the apex slightly smaller, more or less hexagonal with the longer diameter transverse, about .010–.015 mm.: seta erect, about 1.5–3.5 cm. long, smooth, lustrous, castaneous, somewhat sinistrorse; capsule lustrous, castaneous, linear-cylindric, usually slightly curved, about 5–8×1 mm.; peristome-teeth obtuse, about 2.5 mm. long; calyptra cucullate, slenderly rostrate, about 4–7 mm. long; operculum hemispheric, slenderly rostrate, about 2.5 mm. long and more or less abruptly divaricately bent; spores about .012–.018 mm., pale, orange-pellucid, smooth to minutely roughened, somewhat incrassate, mature in late fall and winter.

Occurring on wooded shaly or clayey banks; Europe, Asia, and, in North America, from Newfoundland and Ontario to the Gulf States. In our region not very common, seemingly preferring steep slopes of ravines, and there often under hemlocks. Quite variable and often approaching closely the two species next following.

Allegheny : Powers Run, November 30, 1908, and Darlington Hollow, October 25, 1908. O. E. J.

Armstrong : Kittanning, October 21, 1905. O. E. J.

Crawford : Hartstown, May 29-31, 1909. O. E. J. and G. K. J. (Figured).

3. **Catharinaea papillosa** New Species.

(Plate XXVII)

Plants loosely cespitose, dark green, dioicous: stems simple or at the base sparsely branched, towards the base radiculose, erect, about 2 cm. high, chestnut-brown to purple; lower leaves dark green, short, oblong, above gradually longer, erect-spreading, the upper leaves tufted, erect-spreading to erect, oblong-linear, 3–5 mm. long, 0.7–1.0 mm. wide, margined, above chlorophyll-bearing, obtuse to somewhat acute, towards the apex dorsally serrate-spinulose, in the margin above the middle more or less doubly serrate-spinulose, when moistened slightly undulate, when dry crisped and circinate, lamellate ventrally along the percurrent costa; lamellæ 6–8, mostly 10–14 cells high, smooth or minutely and sparsely papillose, above the middle extending over ½–⅔ the width of the leaf; leaf-cells on both sides usually slightly minutely papillose, the lower cells hyaline, hexagonal-rectangular, about 10–15 by .030–.045 mm., the median more or less quadrate, the upper cells quadrate-orbicular, chlorophyll-bearing, about .008–.015 mm., the lower border cells linear, incrassate, in two to three series, more or less two-layered, towards the apex gradually becoming rectangular, in the teeth triangular and sometimes .125–.140 mm. long; perichætial leaves similar to the stem-leaves; the perigonial leaves of the antheridial plants from an ovate-orbicular concave base abruptly linear-acuminate, about 2 mm. wide and 3 mm. long, towards the apex canaliculate, lamellate marginally and dorsally serrate-spinulose and usually sparsely papillose; lamellæ usually papillose, 4–6, only 3–7 cells high, disappearing quickly below the base of the acumen: flowers dioicous or rarely arising from the center of the masculine flower of the preceding year: seta solitary, erect, flexuous, slightly sinistrorse, about 2 cm. long, smooth, sublustrous, chestnut-brown; capsule linear-cylindric, 3.5–6 mm. long, 0.5–0.7 mm. in diameter, erect-arcuate, tapering abruptly at the base, smooth, chestnut-brown; cells of the capsule rectangular, their lateral walls much incrassate, in a series of 5 or 6 cells under the mouth smaller, quadrate, dark-incrassate; peristome teeth 32, linear-oblong, about 0.3 mm. high, in the median line reddish-orange, towards the sides hyaline, in the margins a little dark and densely although minutely papillose, forming a basal membrane in the lower third; spores smooth, incrassate, orange-pellucid, globose, about .008–.011 mm.; calyptra about 5 mm. long, narrowly cucullate, much shorter than the capsule, towards the apex spinulose-hairy; operculum hemispheric-conic, shining, dark chestnut-brown, terminating in an oblique linear-subulate rostrum 1.8 mm. long. Known from the following localities:

Allegheny : Along a shaly roadside bank at the west end of Fern Hollow Bridge, Pittsburgh, Pennsylvania. O. E. Jennings, March 8, 1908. *Type*. (Figured). (Two pockets of specimens deposited in the Pennsylvania Herbarium of the Carnegie Museum). Same locality March 26, 1910. O. E. J.; Stoops Ferry, October 7, 1905. O. E. J. and G. E. K.; Library P. O., April 29, 1906. O. E. J.

Beaver : Beaver Falls, May 11, 1907. O. E. J.

Bedford : Wills Mt., near Hyndman, October 9, 1904. O. E. J.

Butler : Valencia, September 27, 1905. O. E. J.

Fayette : Ohio Pyle, May 30-31, 1908. O. E. J.

Washington : Hanlin, May 23, 1908, and Charleroi, June 24, 1908. O. E. J.

Westmoreland: "Shades," east of Blackburn, March 25, 1910. O. E. J. and G. K. J.

4. **Catharinaea plurilamellata** New Species.

(Plate XXVII)

Loosely cespitose, dark green, dioicous: stems simple or sparsely branched below, slightly radiculose towards the base, about 1.5 cm. tall, erect, flexuous, reddish-brown; lower leaves dark green to purplish, short, becoming abruptly longer above; upper leaves clustered, erect-spreading to erect, linear-lanceolate, 4–7 mm. long, .9–1.3 mm. broad, margined, above with chlorophyll, obtuse to sub-acute, toothed on the back towards apex, more or less doubly serrate in the apical third, not very strongly undulate when damp, crisped and circinate when dry; lamellæ 7–12 in number, 8–14 (usually about 11) cells high, smooth or sometimes sparsely minutely papillose, usually occupying from ⅔ to ¾ of the width of the upper part of the leaf; lower cells rectangular, about .010–.016×.025–.035 mm., the upper rounded-quadrate, about .007–.013 mm., the lower marginal cells linear, incrassate, 2- to 3-seriate and more or less bi-stratose, towards the apex becoming rectangular, with triangular teeth about .025–.040 mm. long; perichætial leaves similar: seta solitary, erect, flexuous, somewhat sinistrorse, about 1.5–2 cm. long, smooth, shining, reddish-brown; capsule oblong-cylindric, 4–5 mm. long, 0.6–0.9 mm. in diameter, erect, arcuate, abruptly tapering at the base, reddish-brown, smooth, shining when fresh; peristome teeth 32, linear-oblong, about 0.25 mm. high, reddish-orange along median portion, hyaline towards margins, when young with densely minutely papillose margins, the lower one-fourth portion united into a basal membrane; spores smooth, incrassate, orange-pellucid, globose,

about .008–.011 mm.; calyptra about 5–6 mm. long, narrowly cucullate, extending to about the middle of capsule, spinulose-hairy on apex; operculum hemispheric-conic, shining reddish-brown, terminating in a linear-subulate oblique beak about 2 mm. long. Known only as follows:

Allegheny : Powers Run, September 21, 1905, May 30-31, 1908. O. E. J.

Fayette : On shaded woodland bank, Ohio Pyle. O. E. J. and G. E. K., September 10, 1905. (Figured). ***Type.*** (Deposited in Pennsylvania Herbarium of the Carnegie Museum.

Westmoreland: Miss K. R. Holmes, 1902.

2. *POGONATUM* Beauvois.

Dioicous: gregarious to weakly cespitose: fertile stems arising from a creeping underground stem or from a radiculose protonema, erect, stiff, short and simple or some longer and branched; leaves gradually longer upwards, erect-spreading to recurved, more or less clasping at base, stiffened by mostly numerous lamellæ, especially towards the apex, the margins more or less distinctly spinulose, leaf-blade smooth dorsally, usually for the most part bi-stratose; the lower part of costa narrow and plane, dorsally towards the apex toothed; cells of the leaf-blade small, incrassate, in the unistratose border mostly quadrate or transversely elongate, basal cells elongate to linear, yellowish to hyaline, thinner walled: seta solitary, sometimes more, castaneous; capsule erect, straight or curved, cylindrical, without stomata; peristome-teeth 32, pale to yellowish-brown with a darker axis; operculum convex and more or less long-rostrate; calyptra mitrate, densely hirsute, more or less shaggy.

A large genus of about 165 species, growing on earth, widely distributed; about 45 species in North America; only one species yet found in our region.

Key to the Species.

a. Robust, 5–15 cm. high, branching; marginal cells of lamellæ papillose. b.

a. Mostly short, simple; marginal cells of lamellæ elliptic and smooth. c.

b. Leaf-margins entire. (*P. brachyphyllum* [Richard] Schwaegrichen).

b. Leaf-margins more or less serrate. 1. *P. pennsylvanicum.*

c. Exterior cells of lamellæ round in cross-section: capsule more or less papillose. (*P. urnigerum* [Linnæus] Beauvois).

c. Exterior cells of lamellæ ovate in cross-section: capsule not papillose. (*P. norvegicum* [Hedwig] Beauvois).

1. **Pogonatum pennsylvanicum** (Hedwig) Paris.
(*Polytrichum pensilvanicum* Hedwig; *Pogonatum brevicaule* Beauvois; *P. tenue* E. G. Britton).

(Plate XXVIII)

Plants scattered on a green felt-like persistent protonema which covers the moist, bare clay: stems very short, usually about 1–2 mm. long; leaves lanceolate-subulate, the lower shorter and more ovate, narrowing abruptly to an acuminate apex, margins serrulate in the upper half; upper leaves lanceolate with a long-acuminate, serrulate apex, appressed or somewhat spreading; lamellæ 5 or 6 cells high, terminal cell orbicular to ovoid in cross-section, smooth: seta slender, smooth, yellowish to reddish; calyptra light yellow, very hairy and more or less shaggy, completely covering the capsule; capsule erect, symmetric, long cylindric, minutely papillose, slightly or not at all constricted below the lid, yellowish to reddish, about 4 mm.×0.8 mm.; lid obtuse to truncate, abruptly tipped with a beak about 0.4 mm. long; spores maturing in our region about November.

A common moss on bare clay banks, especially if somewhat moist and shaded, from Nova Scotia to Missouri and south to Alabama. Common in our region.

Allegheny : Ten localities, different dates; O. E. J. Darlington Hollow, October 12, 1908. O. E. J. (Figured). Coraopolis, September 4, 1905, and Power's Run, September 14, 1905. O. E. J. and G. E. K.; Wildwood Road, March 29, 1908. O. E. J. and G. K. J.

Armstrong : Kittanning, October 21, 1905; West Kittanning, September 27, 1909. O. E. J. and G. K. J.

Beaver : Beaver Falls, May 11, 1907, Smith's Ferry, along Ohio River bank, October 1, 1910. O. E. J.

Center : On red clay, near Scotia, September 22, 1909. O. E. J.

Crawford : Linesville, May 12, 1908. O. E. J.

Fayette : Ohio Pyle, May 30, 1908. O. E. J.; Ohio Pyle, September 1-3, 1906, and Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J. Ohio Pyle, September 10, 1905. O. E. J. and G. E. K.

McKean : Quintuple Ridge, September 4, 1898. D. A. B.; Kane, September 5, 1909. O. E. J.

Washington : Charleroi, October 14, 1905. O. E. J. and G. E. K.; along north branch of Maple

Creek, Charleroi, April 26, 1908. O. E. J. Westmoreland: Hillside, May 19, 1906, and May 22, 1909. O. E. J. "Shades," three miles east of Trafford, March 25, 1910, Chestnut Ridge, above Hillside, May 23, 1908, and September 16-17, 1909. O. E. J. and G. K. J.

3. *POLYTRICHUM* Dillenius, Hedwig.

Dioicous; antheridial flowers cup-shaped, sprouting from the middle: robust, stiff, in green to bluish-green, mostly high tufts; stem with a complex central strand, rising from a subterranean rhizome, often whitish tomentose, mostly simple; leaves dense, erect-spreading to recurved, drying stiffly erect, from a sheathing scarious base elongate-lanceolate to linear-subulate, non-bordered, with margin plane to involute, sharply serrate, the sheathing base unistratose and hyaline, at least at the angles; lamina bi-stratose except at the margin; costa narrow and flat below, above stronger, dorsally toothed towards apex, mostly excurrent as a colored, toothed awn; lamellæ erect, high, numerous, covering the costa and the bistratose lamina ventrally; cells in the sheathing base elongate-rectangular to linear, narrower marginward; laminal cells small, incrassate, quadrate-hexagonal: sporogonia solitary; seta long, stiff yellowish-red to purplish, often drying flat and sinistrorse; capsule first erect, finally inclined or horizontal, mostly prismatic, 4–6-angled, oblong to cubic, collum hemispheric or disk-like, with stomata; spore-sac free; teeth 64, with a colored axis, basal membrane colored; operculum large, conic to convex, rostrate; calyptra cucullate and with the long, shaggy hairs completely enclosing the capsule.

About 125 species, mainly on soil in the cooler parts of the globe; 22 species in North America; at least 5 species in our range.

Key to the Species.

a. Exothecial cells of capsule not pitted; hypophysis not distinct; capsule longer than broad. 1. *P. ohioense.*

a. Exothecial cells of capsule with large pits; hypophysis disk-like, distinct with a constriction above; capsule approximately cubic. b.

b. Leaf-margin entire, broad and inflexed; marginal cell of lamellæ not emarginate in cross-section. c.

b. Leaf-margin sharply serrate, not inflexed; marginal cells of lamellæ emarginate in cross-section. 5. *P. commune.*

c. Excurrent costa hyaline, long; plants low (about 1.5–2 cm.), simple. 2. *P. piliferum.*

c. Excurrent costa red, short; plants larger. d.

d. Stems not or but slightly tomentose; capsules oblong-tetragonal. 3. *P. juniperinum.*

d. Stems covered below with whitish tomentum; capsules more or less cubic. 4. *P. alpestre.*

1. **Polytrichum ohioense** Renauld and Cardot.

(Plate XXVIII)

Erect, loosely cespitose, about 2.5–7 cm. high (gametophyte), olive-green: stems wiry, slightly or not at all tomentose below, chestnut-brown; leaves widely spreading when moist, erect-appressed when dry, or with the tips flexuous-spreading, lower leaves small and linear, the upper about 8–12 mm. long, the linear-lanceolate limb spreading from an oblong sheathing base about 2–3 mm. long, the limb serrate and ending in a spinulose, stiff, pellucid acumen, very strongly costate, the costa with about 40–50 lamellæ; lamellæ 4–6 cells high, the terminal cell wider but not longer and not bi-cuspidate or retuse; cells in alar portion of sheathing base of leaf elongate-rectangular, about .010–.015×.100–.130 mm., prosenchymatous or parenchymatous, in middle of sheathing base narrower and proportionally longer, somewhat incrassate, in limb rounded, incrassate and pellucid-opaque; perichætial bracts similar but with a longer more hyaline sheathing base and a narrower limb: seta 4–8 cm. long, wiry, flexuous, lustrous, chestnut-brown shading to golden above, erect; capsule erect soon becoming more or less horizontal, acutely 4– (5) angled, narrowed towards the base, about 2–3 by 4–6 mm., yellowish-brown, hypophysis small but distinct: peristome-teeth pale yellow with a darker median portion, about 0.2–0.25 mm. long; spores round, smooth, .015–.017 mm., mature in midsummer; cells of exothecium about .007–.010 by .010–.015 mm., quadrate to hexagonal, incrassate, non-porose; operculum with a rostrum about equal in length to the diameter of the capsule; calyptra yellowish, exceeding the capsule.

On earth in moist woods, Alaska to Labrador, south to Missouri and Alabama, also in northern Europe.

Allegheny : Stoop's Ferry, October 7, 1905, Stewart's Stop, Charleroi Electric R. R., August 19, 1907. Wildwood Road, March 29, 1908. O. E. J. and G. K. J.; Power's Run, September 14, 1906. O. E. J. and G. E. K.; Carnot, May 25, 1902, December 5, 1888, and Laschell Hollow, June 15, 1902. J. A. S.; Power's Run, July 31, 1904, Stoop's Ferry, June 4, 1906, Schenley Park, Pittsburgh, July 10, 1905. O. E. J.

Armstrong : Kittanning, August 22, 1903. D. R. S.; Kittanning, October 12, 1905, August 16, 1906. O. E. J.

Cambria: : St. Lawrence, July 24, 1908. O. E. J.

Clearfield : Clearfield, July 13, 1908. O. E. J.

Crawford	: Linesville, June 6, 1904, May 12, 1908. O. E. J.
Erie	: Presque Isle, June 9-11 and September 20-22, 1906. O. E. J.
Fayette	: Ohio Pyle, May 13, 1905. O. E. J., September 10, 1905. September 1-3, 1906, and September 1-3, 1906, and September 1-3, 1907 (Figured), and Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
Huntingdon	: Birmingham, May 17, 1904. O. E. J.
Indiana	: Cherry Tree, July 11, 1908. O. E. J.
Lawrence	: New Castle, 1906. Miss Susan Gageby.
Mercer	: Houston Junction, July 12, 1902. J. A. S.
McKean	: Marilla, July 5, 1896, Rutherford, July 29, 1896, September 16, 1898, Beardsley's Run, June 7, 1896, Bennett, May 30, 1897. D. A. B.
Washington	: Hanlin, May 21, 1908. O. E. J.
Westmoreland	: Jacob's Creek, August 10, 1902. Laurelville, May 30-31, 1903. J. A. S.; Delmont, June 28, and July 3, 1903. Miss Katherine Holmes; Saunders' Station, June 22, 1907. O. E. J. and G. K. J.; Hillside, May 23, 1908, May 22, 1909, and September 16-17, 1909, New Florence, September 8-11, 1907, Trafford August 22, 1910. O. E. J.

2. **Polytrichum piliferum** Schreber, Hedwig.

(Plate XXVIII)

Rather loosely cespitose, light green, rather glaucous: stems simple, erect, 1–4 cm. high, purplish-brown, radiculose slightly at the base, leafy only in the upper 1 cm. or thereabouts; leaves when moist ascending, when dry imbricate-appressed, base hyaline, rounded-oblong, about 1.5 mm. long, the limb narrowly lanceolate, about 3 mm. long with wide margins inflexed and in the upper part meeting or over-lapping, the apex abruptly terminating in a hyaline, linear, dentate arista about 1 mm. long; costa wide, with about 25–35 lamellæ ventrally, dorsally more or less papillose or dentate; lamellæ usually of 6–7 cells, the terminal one slightly wider and apically abruptly elongate; leaf-cells in alar region of sheathing base quadrate to rectangular or hexagonal, hyaline, slightly incrassate, in middle of sheathing part larger, rectangular, about .015–.018×.030–.040 mm., somewhat brownish-pellucid, incrassate, at base of limb abruptly passing into rather opaque or brown-pellucid, much incrassate, rounded cells, about .010–.015 mm. in diameter, in reflexed margin of limb larger and ir-

regularly obliquely rhombic: seta about 2–3.5 cm. long, erect, flexuous, lustrous, light chestnut-brown to paler above; capsule small, about 2–2.5 mm. long, tetragonal-oblong to almost cubic, sharply angled, erect to pendulous, usually horizontal in age; operculum shortly rostrate; calyptra covering whole capsule; cells of exothecium hexagonal with a large oblong pore one-half the diameter of the cell; peristome-teeth rather hyaline, about 0.2 mm. high; spores round, smooth, about .010–.012 mm., mature in mid-summer.

In dry, sandy soil, heaths, etc., in cooler regions over almost the whole earth. In North America ranging from the Arctic regions south to the northern part of the Gulf States and California.

Erie	: Presque Isle, on Sand-Plain, September 20-22, 1906. O. E. J.
McKean	: Bradford, December 23, 1896. D. A. B. (Figured).
Washington	: Near Washington, Linn and Simonton. (Porter's Catalogue).

3. **Polytrichum juniperinum** Willdenow, Hedwig.

(Plate XXIX)

Rather loosely cespitose, erect, light green and somewhat glaucous: stems slightly tomentose at base, in our specimens about 5–9 cm. high, brown; leaves rather crowded, when moist spreading, when dry erect-appressed, or in the older stems somewhat spreading, the base oblong, sheathing, the limb lance-linear, 5–6 mm. long, the margin entire or crenulate and inflexed, the costa strong and excurrent into a reddish dentate arista; cells at base of sheathing portion of leaf linear-rectangular, mainly parenchymatous, moderately incrassate, in middle portion of sheath relatively wider, about .010×.040–.090 mm., both prosenchymatous, in inflexed margin of limb obliquely quadrate-rectangular-elongate, decidedly incrassate; lamellæ about 30–40, usually 6–7 cells high, the terminal cell somewhat broader and with an abruptly narrowed shortly prolonged apex; perichætial leaves more hyaline with a longer sheathing base and a considerably longer slightly dentate arista: seta erect, flexuous, lustrous, about 4–6 cm. high, somewhat sinistrorse; capsule tetragonal-oblong, about 3–5×2–2.5 mm., sharply angled, reddish to dark chestnut-brown when old, apophysis short but rather distinct, capsule pendulous to horizontal; spores round, smoothish, about .008–.011 mm., mature in midsummer; cells of exothecium elongate-hexagonal to quadrate-hexagonal, the perforation linear-oblong, about half as long as cell.

Heathlands, dry pastures, thin woods, etc., in hilly and mountainous regions almost the world over. Common in our region.

Allegheny	: Near Library P. O., April 29, 1906. O. E. J.
Armstrong	: On ground in dry pasture, Kittanning, September 24, 1904. O. E. J. (Figured).
Butler	: Slippery Rock, 1906. Miss Susan Gageby.
Cambria:	: Near Cresson, May 18, 1904. O. E. J.
Center	: Slope of Bald Eagle Ridge near Mattern, September 20, 1909. O. E. J.
Clearfield	: Between Clearfield and Pottersdale, July 13, 1908. O. E. J.
Clinton	: Near Lock Haven, July 15, 1908. O. E. J.
Crawford	: Linesville, May 12, 1908. O. E. J.
Erie	: Presque Isle, May 8-9, 1906. O. E. J.
Fayette	: Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.; May 13, 1905. O. E. J.
McKean	: Langmade, April 26, 1896. D. A. B.
Mercer	: Half-moon Swamp, June 12, 1906. O. E. J.
Potter	: Keating Summit, July 21, 1904. O. E. J.

4. **Polytrichum alpestre** Hoppe, Schwaegrichen.
(*Polytrichum strictum* Banks, Menzies).

(Plate XXIX)

Large mosses forming dense tufts up to 20 cm. deep, tufts matted with a dirty-white tomentum: stems branching, rather slender, often matted tomentose to within 2–3 cm. of the apex; leaves more or less rigidly appressed-imbricate when dry, when moist with the lance-linear limb spreading and 4–5 mm. long, from an oblong sheathing base about 1.5 mm. long, margin of limb entire, inflexed, the apex rather abruptly narrowed into a linear, reddish-pellucid, slightly serrate acumen, leaves dorsally serrulate nearly to the sheathing base, the costa bearing ventrally about 25–35 lamellæ; lamellæ 5–8 cells high, the terminal cell broader and abruptly narrowing to an obtuse short acumen, as seen in cross-section; areolation of sheathing base almost hyaline, not so markedly incrassate, the median basal rectangular, 4–8 times as long as broad, towards the margin and upwards in the sheathing portion narrower, longer, either prosenchymatous or parenchymatous, cells of inflexed margin of limb obliquely quadrate or rectangular to linear-oblong in the border, incrassate; perigonial leaves of male plant obovate-orbicular, the costa broad, lamellate on the upper half, percurrent in a broadly acute acumen: seta erect, slender, wiry, sinistrorsly flexuous, 4–8 cm. long, lustrous, rich chestnut-brown below and lighter above; capsule more or less cubic, 2–3 mm. long, acutely angled, papillose, yellowish to chestnut-

brown, apophysis distinct; cells of exothecium more or less hexagonal, the central pore round to oblong, often one-third the diameter of the whole cell; peristome about 0.2 mm. high, teeth rather slender; calyptra yellowish-brown, covering the capsule; operculum flattened, the rostrum about 0.5 mm. long. Evidently mature in midsummer.

From the Northern States to the Arctic regions; southern South America; northern Europe and Asia. In bogs or boggy woods. Rare in our region.

Crawford : In small *Cassandra* bog near Linesville, May 28, 1908. O. E. J. (Figured).

Washington : Hanlin, in tuft of *Leucobryum*. May 21, 1908. O. E. J.

5. **Polytrichum commune** Linnæus, Hedwig.

(Plate XXIX)

Large, erect, 10–20 cm. high, loosely cespitose in large masses, rather dark olive green: stems simple, flexuous, woody, slightly or not tomentose at base, chestnut-brown, rather densely foliate above; lower leaves small, linear, becoming gradually larger above up to about 15 mm. long, the limb linear-lanceolate from an oblong sheathing base, when moist spreading or recurved, when dry appressed-erect, serrate to the sheathing base, the apex linear, serrate, pellucid; areolation at base of sheath parenchymatous, rectangular, above becoming linear-prosenchymatous, abruptly grading at base of limb into rounded incrassate cells about .010–.015 mm. in diameter, towards apex becoming elliptic with the longest diameter transverse, all pellucid to more or less opaque; lamellæ 40–60, 5–7 cells high, the terminal cell broader and retuse to bi-cuspidate at apex, the lamellæ extending almost to the base of limb; perichætial bracts with a longer sheathing portion and few or no lamellæ; antheridial flowers conspicuous, cup-shaped, the broadly obovate shortly acuminate bracts which form the cup being about 4 mm. long, the costa broad and weak below but stronger and bearing numerous lamellæ in the upper half; the successive annual growths of the male plant taking place from the center of the antheridial flower of the preceding season: seta wiry, flexuous, 6–10 cm. long, lustrous, chestnut to light golden-brown; capsule erect, but later inclined, and, when old and empty, cernuous, light to deep chestnut-brown, more or less cubical or shortly rectangular, apophysis discoid, distinct; capsule-urn about 3–5 mm. long; operculum low-conic, the beak about 1 mm. long; peristome-teeth about 0.25 mm. high, more or less reddish-pellucid; exothecial cells hexagonal, the outer face convex and with a rounded to elliptic pore; spores round, smooth, about .008–

.010 mm., mature in mid-summer; calyptra covering the whole capsule, rather lustrous, yellowish-brown.

Cosmopolitan; in North America almost throughout, in marshy places, pastures, woods, etc.

Allegheny	: Brush Creek, near Douthett, April 26, 1908. O. E. J.
Armstrong	: Buffalo Creek, east of W. Winfield, June 20, 1904. O. E. J.
Beaver	: Near Beaver, J. A. S. and W. N. M. October 19, 1901.
Butler	: Buffalo Creek, near Winfield Jct., May 26, 1906. O. E. J.
Cambria	: Cresson, May 18, 1904. O. E. J.; Lloydville, July 23, 1908. O. E. J.
Cameron	: Miller, July 19, 1904. O. E. J.
Center	: Tussey's Mt., above Shingletown, July 15, 1909. O. E. J.; Barrens near Scotia, July 16, 1909. O. E. J.
Crawford	: Linesville, May 18, and June 12, 1905. O. E. J.
Elk	: Dent's Run, July 19, 1904. O. E. J.
Erie	: Presque Isle, May 8-9, September 20-22, 1906. O. E. J.
Fayette	: Ohio Pyle, July 10, 1908, June 14, 1908, May 30-31, 1908. O. E. J.
Indiana	: Bank of Cush-Cushing Creek, near Cherry Tree, July 11, 1908.
Lawrence	: New Castle, 1906. Miss Susan Gageby.
McKean	: Westbrook Swamp, Bradford, June 2, 1896, Bradford, June 9, 1896, West Branch Swamp, Bradford, June 21, 1896. D. A. B.; Larabee, July 21, 1904. O. E. J.
Mercer	: Houston Junction, July 12, 1902. J. A. S.; Half-Moon Swamp, June 12, 1906. O. E. J.
Somerset	: Keystone, October 9, 1904. O. E. J.
Westmoreland	: Between Ligonier and Donegal, June 23, 1904, "Rachelwood," slope of Laurel Hill Mts., near New Florence, September 8-11, 1907. O. E. J.

5*a*. **Polytrichum commune** variety **uliginosum** Huebener.

In this variety the stems are less strong and rigid than in the species, and the leaves in the dry specimens are widespreading to recurved. It is rather rare in the eastern part of the United States.

Cambria : Cresson, May 18, 1904. O. E. J.; upland plateau near St. Lawrence, July 24, 1908. O. E. J.

Crawford : Near Linesville, May 12, 1908, and Hartstown, June 26-28, 1908. O. E. J. (Figured). (Near Linesville this variety forms quite extensive heaths in the low-lying peaty pastures around the Pymatuning Swamp, especially on the low mounds of peaty soil formed by the uprooting of trees and their subsequent decay.

Family XXIII. *HEDWIGIACEAE.*

Autoicous or dioicous, rarely synoicous; paraphyses long, yellow, filiform: more or less robust, stiff, cespitose; stem without central strand, irregularly to almost pinnately branched, rarely with long, pendent, 2–3-pinnate branches, densely-leaved, radiculose below, sometimes stoloniferous; leaves about 8-seriate, spreading, drying imbricate, broad, thin, ecostate, concave, sometimes plicate, papillose; lamina one-layered, golden-brown at base, cells incrassate, punctate, non-margined, with several rows of small quadrate cells in the alar portion, or margined with the alar portion concave, sharply differentiated by large, colored, 4–6-sided cells; leaves on stolons recurved-squarrose, from a wider base suddenly long piliferous-acuminate; perichætial leaves erect, longer than the stem-leaves, with ciliate margins at apex; seta various; vaginula ciliate; capsule short, erect, shortly and thickly collumate; annulus none; spores large; operculum low, convex to rostrate; calyptra minute and mitrate to large and cucullate.

A small but widely distributed family of six genera, only one genus in our region.

1. *HEDWIGIA* Ehrhart, Hedwig.

Autoicous: laxly cespitose, glaucous-green: non-stoloniferous, erect to ascending, irregularly branched; leaves concave, ovate, tipped with a hyaline, serrate to ciliate acumination, margins revolute, entire, non-bordered; leaf-cells two- to several-papillose, papillæ on both sides, the upper cells oblong, the lower elongate, the median basal yellow, linear, becoming quadrate and brownish towards the angles; perichætial leaves larger, the upper margins furnished with long, sinuose, articulate, sometimes toothed cilia: seta about 5–8 mm. long, yellow, thicker upwards; capsule immersed, obovate to globose, smooth, pale brown, the mouth red and wide; spores .028–.032 mm., yellow with vermiform lines; operculum plano-convex, red, sometimes unbonate; calyptra minute, conic-mitrate, fugaceous, covering only the apex of the operculum.

A cosmopolitan genus of 8 species, occurring on non-calcareous rocks; 3 species in North America, only the following in our range.

1. **Hedwigia ciliata** Ehrhart, Bryologia Europæa.

(*H. albicans* Lindberg; *Fontinalis albicans* Weber; *Anictangium ciliatum* Hedwig).

(Plate XXX)

In patches of varying size up to quite large, blackish or brownish below, glaucous-green above, more or less hoary, especially in late summer or in autumn, owing to the colorless tips of the leaves: stems from 2 or 3 up to 8 or 10 cm. long, rather slender, irregularly forking and branching, the branches usually rather short; leaves more or less secund on the procumbent stems, when dry imbricated but with recurved apex, when moist spreading, concave, ovate, 1.5–3 mm. long, the apex sub-obtuse to long-acuminate, papillose-denticulate to spinulosely denticulate, more or less hyaline; costa none; the median basal leaf-cells yellowish pellucid, not papillose, narrowly linear, incrassate, porose, towards the margin and in upper part of leaf the cells sub-quadrate or rectangular, with more or less sinuose walls, the cells in the angles often brownish and larger, the median and upper cells prominently papillose, longitudinally seriate, varying from quadrate to rounded or hexagonal; perichætial leaves prominently ciliate towards the apex, not plicate: seta practically none: capsule sub-sessile, immersed, globose-oblong, about 0.6–0.9 mm. in diameter, wide-mouthed and truncate when dry and empty, red-rimmed, the urn castaneous; lid convex, sometimes mamillate, about three-fourths as wide as the median diameter of the urn; calyptra small, sub-cucullate and fugacious; annulus none but one or two rows of exothecial cells at the rim of the urn smaller, laterally elongate, and castaneous-pellucid; peristome none; spores mature in spring, minute, shallowly pitted, pale, thin-walled, about .025–.028 mm.: autoicous.

On dry rocks, boulders, stone-walls, etc., in non-calcareous habitats; almost cosmopolitan; in North America occurring from the Arctic regions to Mexico. Common in our region.

Allegheny : On large rock at head of Wildwood-Road Run, November 19, 1908. O. E. J. and G. K. J.; base of white oak at Keown, November 14, 1909. O. E. J.

Beaver : Valley of Little Beaver Creek, near Smith's Ferry, October 1, 1910. O. E. J.

Fayette : Ohio Pyle, July 4, 1908, and May 30-31, 1908. (Figured). O. E. J.; Meadow Run Valley, September 1-3, 1906, and 1-3, 1907.

O. E. J. and G. K. J.

Huntingdon : Tussey's Mt., near Baileyville, July 13, 1909. O. E. J.

McKean : Quintuple, April 17, 1898. D. A. B.

Westmoreland: Mt. Pleasant, August 31, 1903. Katherine R. Holmes.

1*a*. **Hedwigia ciliata** variety **leucophaea** Bryologia Europæa. (*H. albicans* var. *leucophaea* Limpricht).

Very hoary; more robust than the species: leaves more falcate, wider, the hyaline base of the piliferous acumination occupying about the whole upper third of the leaf.

With the type and in the same general habitat.

Huntingdon : Stone Creek, T. C. Porter. (Porter's Catalogue).

Westmoreland: T. P. James. (Porter's Catalogue).

Family XXIV. *FONTINALACEAE.*

Dioicous or autoicous: filiform paraphyses few: slender to robust, aquatic, floating, blackish-green or reddish-brown: stem without central strand, 3–5-angled, or round, much branched but bare below, fastened by a cushion of rhizoids at the base; leaves 3- and 5-seriate, ovate-acute to lance-subulate, carinate to concave or plane, mostly decurrent, rarely winged, entire or dentate at apex; lamina uni-stratose above, bi- to tri-stratose below, with single costa or none; median leaf-cells mostly elongate prosenchymatous, smooth, the basal orange, laxer, rarely loosely rhombic hexagonal: seta rudimentary or normal; capsule erect, non-collumate, without annulus, without stomata; peristome none, single, or double, teeth when present 16, hygroscopic, as long as or shorter than the segments; mostly linear, orange- to brown-pellucid, non-bordered, mostly papillose, ventrally with projecting transverse trabeculæ; inner peristome without basal membrane, segments filiform, 16, usually more or less united into a carinate cone, rarely free and appendiculate; lid short-conic to rostrate; calyptra small and conic or cucullate and reaching to below the capsule.

A family of six genera, confined almost exclusively to the temperate and colder parts of the Northern Hemisphere; two of the genera in our range.

Key to the Genera.

a. Leaves ecostate; calyptra short. 1. *Fontinalis.*

a. Leaves costate; calyptra enclosing the whole capsule. 2. *Dichelyma.*

1. *FONTINALIS* Linnæus, Hedwig.

Dioicous: floral branches apparently axillary, very leafy; antheridial clusters short and obtusely gemmiform; arche-

gonial branches elongate and acute: slender to very robust: stems sharply 3-angled to round, much branched; leaves of one form, 3-seriate, otherwise as for the family, ecostate; perichætial leaves larger, almost enclosing capsule, broadly obovate, obtuse, lacerate when old: vaginule and seta rudimentary; capsule oval to ovate, mostly delicate; peristome double, inner and outer of same length, teeth 16, linear-lanceolate, orange to brownish, plane, papillose, mostly apically united in pairs, the divisural zigzag, articulations prominent, the trabeculæ projecting both ventrally and laterally; segments 16, filiform, united by lateral processes into a plaited cone, rarely free and appendiculate; spores irregular in size, mostly green, almost smooth; lid conic, calyptra reaching but little below the operculum, the base lacerate when old.

A genus of about 50 species; about 30 occurring in North America; at least five occurring in our region.

Key to the Species.

a. Stem-leaves carinate. 1. *F. antipyretica.*
a. Stem-leaves not carinate. b.
b. Alar leaf-cells distinctly differentiated. d.
b. Alar leaf-cells little or not at all differentiated. c.
c. Perichætial leaves with rounded and mostly lacerate apex. 4. *F. delmarci.*
c. Perichætial leaves with an entire abruptly pointed apex. 5. *F. dalecarlica.*
d. Leaf-cells rhombic-hexagonal, not more than 1:6. e.
d. Leaf-cells elongate-linear, about 1:7–30. f.
e. Branches remote, spreading at almost right angles; leaves not dimorphic. 6. *F. novae-angliae.*
e. Branches close, erect-spreading; vernal leaves replaced by summer leaves of a different form. 2. *F. biformis.*
f. Alar leaf-cells much differentiated; leaf-apex entire. 3. *F. sullivantii.*
f. Alar leaf-cells but moderately inflated; leaf-apex mostly plainly toothed. 7. *F. lescurii.*

1. **Fontinalis antipyretica** variety **gigantea** Sullivant.

(*Fontinalis gigantea* Sullivant).

Floating, long, dark, brownish-green or golden green: stems denuded below, slender, up to sometimes 6 or 8 dm. long, irregularly divided; the branches turgidly three-cornered and sometimes 2 or 3 dm. long; leaves deeply concave, carinate, up to 6–8 mm. long, 3–4 mm. wide, broadly ovate or lance-ovate, entire, acute, plane-margined; median leaf-cells about 8–15:1, linear-rhomboid and more or less vermicular, the apical and basal shorter and wider, the alar sub-rectangular and inflated; perichætial leaves closely imbricated, the

upper sheathing, truncate, rounded, entire, or lacerate at the apex: capsule rather small, sub-sessile, usually only the rostrate calyptra and the conic lid emergent from the sheathing perichætial leaves when mature, about 2:1, more or less turgid-oblong; lid reddish; peristome usually a bright coral color, the inner peristome united at the apex and sometimes well down towards the middle into a perfect lattice-work, the bars incomplete below; spores mature in summer.

In cool streams and in ponds, on stones or on wood; Europe, Asia, northern Africa, and from Canada through the United States to Alabama. Scarce in our region.

Blair : T. P. James. (Porter's Catalogue).
Cambria : T. P. James. (Porter's Catalogue).
McKean : D. A. Burnett. (Porter's Catalogue.

2. **Fontinalis biformis** Sullivant.

Yellowish green to dirty green: stems long, much-branching; leaves of two kinds; the vernal large, soft, lance-ovate, concave, blunt to acute, when fresh and moist quite prominently three-ranked, and rather widely spreading; the summer leaves much smaller, narrower, convolute and tubulose above, rigid, covering the younger branches; median leaf-cells of the vernal leaves linear, the apical broadly rhomboidal, the angular quadrate-oblong, much larger, forming small decurrent auricles; costa none; archegonial clusters rare, situated towards the base of the stems; antheridial clusters usually 2 to 4 together and long-stipitate: capsule oblong-oval, enfolded by the perichætial leaves; lid conic, rostrate; peristome-teeth lance-linear, about 20-articulate, cilia tessellate and united at the apex, papillose.

In wood-land rivulets and streams; from New England to Florida and west to British Columbia, but not very common. Rare in our region. Portage County, Ohio, and:

McKean : D. A. Burnett. (Porter's Catalogue).

3. **Fontinalis sullivantii** Lindberg.

(*F. lescurii* variety *gracilescens* Sullivant).

Quite similar to *F. lescurii* but smaller and more slender: very slender, regularly pinnate with remote and attenuate branches; leaves distant, the stem-leaves lanceolate, soft, narrowly long-acuminate, somewhat concave, acute to somewhat obtuse, entire or sub-denticulate, yellowish, about 5 mm. long; the branch-leaves about half as long, more rigid, more concave, acuminate; perichætial leaves rather short as compared with *F. lescurii,* not undulate at apex; median leaf-cells linear-flexuous, the apical shorter and broader, the basal shorter and broader, the alar much larger, inflated-oblong: capsules sessile, cylindric; lid conic, long-acuminate; peristome teeth

papillose, the inner peristome as in *F. lescurii;* spores minutely roughened.

In streams in the mountains or hills, northeastern United States. Not reported from our region.

4. **Fontinalis delmarei** Renauld and Cardot.

Dull green, naked below, much divided: stems and branches irregularly pinnate with rather robust, unequal, obtuse, erect-spreading branches; leaves crowded, erect-spreading, slightly incurved on the borders, very concave, lance-oblong, bluntly acuminate, non-carinate; median leaf-cells elongate-linear, somewhat flexuous, a few at the angles small, quadrate-hexagonal; perichætial leaves with a rather rounded but often lacerate apex: capsule sub-immersed, oblong to oblong-cylindric, lid conic-acuminate; peristome-teeth lance-linear with about 15–18 articulations, with the divisural distinct at base only, entire, inner peristome with a united lattice work only at the apex, below papillose and with imperfect bars.

A rather rare species reported from Miquelon and New Jersey but, as we now think, probably not to be expected in our region.

5. **Fontinalis dalecarlica** Bryologia Europæa.

(Plate XXX)

Stems slender, much-branched, naked below, 1–3 (4) dm. long, attenuate, dark-castaneous, sub-lustrous; leaves somewhat close, erect-spreading to somewhat imbricate, more or less glossy, lance-oblong to narrowly lanceolate, acuminate, 2–3 mm. long, often slightly toothed at apex, margins usually somewhat involute, concave, sometimes very slightly auricled at base; leaf-cells prosenchymatous, rather incrassate, linear-oblong, about 10–18:1, the marginal slightly narrower, the alar rectangular to irregularly quadrate-hexagonal, considerably larger, usually slightly colored; perichætial leaves apiculate, the apex finally lacerate: capsule immersed, about 2 mm. long; peristome orange to brownish, the teeth slender, granulose, with about 14–22 lamellæ, the inner peristome with an imperfect lattice; spores muriculate, about .025–.032 mm., mature in summer.

In rapidly flowing streams, occurring from Greenland to Kansas and the Gulf States, also in Europe. Rare in our region.

Center : In swiftly running mountain-stream about three miles south of Boalsburg, September 22, 1909. Sterile. O. E. J. (Figured); Bear Meadows. T. C. Porter. (Porter's Catalogue).

6. **Fontinalis novae-angliae** Sullivant.

(Plate XXX)

Rather bright green, fairly firm: stems usually 3–4 dm. long, wiry, purplish-black, slender, rather freely branching, naked below but quite densely foliate towards the apex; leaves rather close, somewhat appressed, thin, entire, sometimes faintly serrulate at apex, the main branches with leaves about 2–2.5 mm., broad when moist, the branches more or less linear-attenuate; leaves about 3–4.5 mm. long, broadly ovate-lanceolate, concave, the margins somewhat revolute, the apex cucullate, rounded-obtuse; median leaf-cells linear-vermicular to somewhat narrowly linear-oblong, prosenchymatous, incrassate, about 6–15:1, the alar cells forming a quite distinct group, quadrate to oblong, moderately enlarged, somewhat incrassate and colored; capsule sub-cylindric to oblong-oval, near base of stem, closely invested by the ovate-sub-orbicular perichætial leaves, which are lacerate when old, capsules rare; peristome-teeth colored, linear-lanceolate, 18–20-articulate, slightly papillose; cilia tessellate and united at apex only, minutely papillose; spores smooth.

In brooks and swift-running streams from Newfoundland to Ontario and North Carolina, but seldom found in our region.

Crawford : Linesville, August 4, 1909. O. E. J.

Westmoreland: Creek below Hillside Station, September 17, 1909. O. E. J. and G. K. J. (Figured).

Huntingdon : Spruce Creek, T. C. Porter. (Porter's Catalogue).

7. **Fontinalis lescurii** Sullivant.

Loose, soft, green to glossy golden-green: stems long, reaching sometimes 3 or 4 dm., naked and blackish below, dividing and branching irregularly except sometimes at the apex, where the branches may be arranged pinnately; leaves erect-spreading, soft, obscurely three-ranked, concave, clasping at the base, lance-ovate to lance-oblong and rather slenderly acuminate, acute to somewhat obtuse, slightly denticulate at the apex, usually about 4–6 mm. long; median leaf-cells about 12–15:1, elongate-linear, flexuous, the apical and basal shorter and broader, the angular enlarged oblong, inflated, forming quite distinct auricles; perichætia numerous towards the base of the stems, perichætial leaves sheathing, the inner rounded-obtuse, broadly ovate, reaching nearly to the apex of the mature capsule: capsule short, sub-cylindric, enclosed by the closely folding perichætial leaves until almost mature, about 2.5:1; lid long-conic; peristome-teeth red-orange, papillose, about 20–25-articulate, the inner peristome more or less com-

pletely united into a lattice-work at the apex but free and merely appendiculate below; spores mature in summer.

On stones in streams from Nova Scotia to Alabama and west to the Rocky Mountains. Rare in our region.

Huntingdon : T. C. Porter. (Porter's Catalogue).
McKean : Bradford. D. A. B. (Porter's Catalogue).

2. *DICHELYMA* Myrin.

Dioicous; antheridial shoots small, gemmiform; archegonial shoots long; slender to robust, shining, green to golden-brown, blackish below; branching various, the branches recurved at the apex; leaves 3-seriate, falcate-secund to circinate, lance-subulate from a slightly decurrent base, carinate-plicate, weakly serrate; costa complete to long-excurrent; median leaf-cells linear, narrow, the alar not wider; inner perichætial leaves long, tubular, sinistrorsely wound around the seta: seta long; capsule ovate, soft, brownish; peristome-teeth 16, lance-linear, obtuse, papillose, spreading either when damp or when dry, often more or less cleft or divided along the median line, trabeculæ low and distant; inner peristome longer and sometimes falling away with the operculum, segments filiform, more or less united; lid about as long as urn, conic, mostly oblique and curved; calyptra enclosing the whole capsule, split along one side, sinistrorse; spores small and uniform in size.

A rather widely distributed genus of 7 species; 5 species occurring in North America; 2 species in our region.

Key to the Species.

a. Leaves subulate; costa long-excurrent. 1. *D. capillaceum.*
a. Leaves acute; costa complete or almost so. 2. *D. pallescens.*

1. **Dichelyma capillaceum** [Dillenius] Bryologia Europæa. (*D. pallescens* Sullivant and Lesquereux; *Fontinalis capillacea* Hedwig).

Yellowish above, brownish to blackish below; stems slender, often 10–15 cm. long, with a few distichous, divaricate, or one-sided branches; leaves erect-spreading, secund to falcate-secund, long-linear from a lance-oval base, about 5–7 mm. long, serrulate towards the apex; costa long-excurrent; perichætial leaves linear, thin, ecostate, pale and twisted and reaching above capsule; leaf-cells narrow, linear-rhomboid: seta short, slender; capsule small, pale yellowish, thin-walled, ovate, the urn truncate and about 1.5–2:1; lid high-conic; peristome double, the teeth shorter than the inner peristome, narrowly linear, densely papillose, segments longer than teeth, constricted at the articulations, pale yellow, papillose, forming a connected lattice-work only above; spores mature in late summer.

On sticks and the bases of bushes in and around the edges of slow streams and ponds; Europe and from New Brunswick and Ontario southward to Pennsylvania. Not yet recorded as occurring within our region.

2. **Dichelyma pallescens** Bryologia Europæa. (*Fontinalis capillacea* Hooker).

(Plate XXXI)

Slender, light yellowish-green, sometimes glossy: stems usually about 5–10 cm. long, the branching sub-distichous; leaves secund, more or less falcate, the ends of the branches and stems appearing hooked, leaves oblong-lanceolate, about 3–5 mm. long, gradually long-acuminate, complicate-carinate, nearly entire; or denticulate above, plane-margined, acute to obtuse; costa percurrent or nearly so; median leaf-cells rhomboid-linear, prosenchymatous, about 8–15:1, rather incrassate, the basal colored and somewhat shorter, a few alar wider and oblong, incrassate, the apical shorter; perichætial leaves about as long or usually longer than the seta and capsule together: seta about 4 mm. long, slender, enclosed in the perichætium; capsule small, thin, ovate, yellowish, about 1 mm. long, truncate by the falling away of the lid; lid high-conic; peristome-teeth linear, rather rudimentary, pale, castaneous-pellucid, with distinct divisural and lamellæ, and about 10–12 castaneous-pellucid, low ventral trabeculæ; segments filiform, longer than teeth, united only at the summit or entirely free, sometimes remaining on the ripe capsule only as short, filiform, cilia-like structures between the teeth; exothecial cells rounded, castaneous-pellucid, incrassate-collenchymatous, the upper laterally oblong and smaller; spores mature in summer, castaneous-pellucid, incrassate, minutely papillose, varying from about .016–.025 mm.

On sticks and the bases of bushes along creeks and around ponds; New Brunswick to Minnesota and Pennsylvania. Not yet found in our region, excepting along the northern border.

McKean : Bradford. D. A. B. (Porter's Catalogue); Riverside, New York, a few miles north of Bradford. D. A. B. October 18, 1897. (Figured).

Family XXV. *CLIMACEAE.*

Dioicous; flowers on secondary stems and at base of branches; gregarious, large and stately, growing in swamps: stems rhizome-like, subterranean, radiculose, with smooth, branched, reddish-brown rhizoids, secondary shoots 3- to several-angled, erect, with tree-like branching, with central strand; branches leafy, cylindric, simple, pinnate or bi-pinnate; paraphyllia numerous; leaves dimorphous, the rhizome and

lower part of stem having scale-like and appressed colored leaves, the upper stem and branches having green leaves; leaves plicate; costa simple, homogeneous, ending below the apex, at the base widened by two or three layers of laminal cells; leaf-cells smooth, upwardly narrow-rhombic, downwards linear, the basal orange, the alar hyaline, lax, thin-walled and forming a distinct group; perichætial leaves numerous, long and slender; sporogonia often aggregated: seta long, erect, stiff, sinistrorse; capsule erect and symmetric or arcuate and unsymmetric; exannulate; peristome double with the parts of equal length; teeth confluent at base, reddish-brown, articulate, papillose, or transversely striate, the lamellæ numerous; inner peristome yellow, papillose, with more or less of a basal membrane, the segments carinate, more or less gaping along the keel, cilia none; spores medium size; operculum rostrate from a convex base; calyptra cucullate.

Two genera: *Girgensohnia,* with one species, in the regions bordering the North Pacific, and the following:

1. *CLIMACIUM* Weber and Mohr.

Mostly as characterized in the description of the family: branches simple, or sometimes almost pinnate, unequal, attenuate; branch-leaves lance-ligulate from a decurrent, auricled base, bluntly to sharply acute, sharply serrate above; inner perichætial leaves abruptly acuminate, entire, short-costate; costa of the leaves strong, ending below the apex, dorsally toothed above: seta 15–45 mm. long, stiff, castaneous; capsule erect, symmetric, almost cylindric, castaneous; teeth lance-linear, acuminate, with a dark red border, with low papillose dorsal plates, and with closely placed trabeculæ; inner peristome orange, vertically striate-papillose, segments linear, carinately gaping, finally divided: spores .015–.020 mm., rusty, warty; calyptra long, narrow, enclosing whole capsule, cleft on one side to apex, sometimes twisted.

A widely distributed genus of about 7 species: 3 occurring in North America and extending into our region.

Key to the Species.

a. Branch-leaves indistinctly auricled and little plicate; median leaf-cells about 8–10:1. 1. *C. dendroides.*

a. Branch-leaves strongly and deeply plicate; median leaf-cells less than 8:1. b.

b. Median cells about 5–7:1; plants of a tree-like form. 2. *C. americanum.*

b. Median cells not more than two or three times as long as wide; plants not so plainly dendroidal. 3. *C. kindbergii.*

1. **Climacium dendroides** [Linnæus] Weber and Mohr.

(*Hypnum dendroides* Linnæus; *Leskea dendroides* Hedwig).

Dendroidal, robust, bright or yellowish-green; the primary stems underground, creeping, divided; the secondary stems rising to a height of sometimes 10 cm., leafless below, bearing at the summit numerous erect-spreading, flexuous, usually straight branches; leaves large; stem-leaves broadly amplexicaul, with a more or less rounded and cucullate or apiculate apex; branch-leaves imbricated, giving to the branches a thick and turgid appearance, about 2×0.7 mm., lance-oblong to lingulate-oblong, denticulate at base but quite sharply serrate above, plicate, somewhat cordate at the base; costa nearly reaching apex; median leaf-cells about 6–10:1, linear-rhomboidal to linear-hexagonal, shorter and wider towards the apex and towards the base, the alar somewhat lax, wider, hyaline, few, forming small auricles; perichætial leaves entire, non-plicate, the inner sheathing: seta deep red, about 2.5–3 cm. long; capsule erect, castaneous, oblong-cylindric, about 4 mm. long, about 3–4:1; lid often remaining attached to the columella, straight, acutely rostrate; calyptra reaching to below the capsule; peristome large, the teeth forming a cone when moist but usually curved in between the segments when dry; spores mature in fall, green in color.

On wet ground in marshes, at borders of streams, margins of swamps and lakes, etc.; Europe, Asia, and from Arctic America south to New Jersey. It may eventually be found to occur in the northern part of our region.

2. **Climacium americanum** Bridel.

(Plate XXXI)

Loosely cespitose, robust, yellowish-green, lustrous: primary stems creeping stolon-like in the leaf-mould, throwing up at intervals dendroidal secondary stems to a height of 5–8 cm.; secondary stems with large, scattering to closely imbricate, ovate, scale-like leaves below, above bearing a closely tufted group of branches; branches ascending, 1.5–2.5 cm. long, terete, acute to obtuse; branch-leaves 1.7–2.2 mm. long, about two-fifths as wide, broadly lanceolate, sharply serrate in upper half, often denticulate below, acute, broadly auriculate, erect-spreading, when dry imbricate, strongly bi-sulcate; costa strong, ending just below apex; median leaf-cells oblong-hexagonal with more or less rounded or truncate ends, 5–7:1, rather incrassate, those of the auricles quadrate along the margin to diamond-shaped towards the interior, the apical and the upper marginal larger and rhombic-oblong: seta erect, stout, dextrorse above, sinistrorse below, castaneous, about 1–1.6 cm. long; capsule castaneous, narrowly cylindric, about 3–5 mm.

long, erect to slightly curved, slightly contracted below the mouth when dry, nearly smooth; annulus none; operculum conic-rostrate, about 1 mm. long; peristome-teeth shallowly inserted, orange-castaneous, non-striate but decidedly papillose, strongly and rather densely trabeculate, the lamellæ and divisural not very distinct, the teeth slender and often perforate below; segments usually longer than teeth, linear, arising from a very narrow and often somewhat perforate basal membrane which is usually inserted entirely below the rim of the urn, the segments yellowish, granular-papillose, perforate-cleft in a ladder-like manner along the median line; cilia none, or sometimes represented by mere stubs rising from the basal membrane; exothecial cells heavily incrassate, castaneous-pellucid, oblong, the upper rounded-quadrate, those at the rim smaller and transversely oblong, darkly incrassate; spores yellowish, minutely roughened, about .016–.018 mm., the walls moderately incrassate.

In damp, shady woods on rotten logs, stumps, wet soil, rocks, etc., often in swamps. From New Brunswick to the Carolinas and Alabama and west to the Rocky Mountain region. Not uncommon in our region but rather rarely found in fruit.

Allegheny	: Darlington Hollow, Sharpsburg, August 17, 1884, J. A. S., Moon Township, 1889. J. A. S. (Figured); along creek near Thornhill, May, 1906. O. E. J. and G. E. K.; near Douthett, April 26, 1908. O. E. J.
Butler	: Along creek north of Douthett, April 26, 1908. O. E. J.
Crawford	: Pymatuning Swamp, Linesville, June 12, 1905, and May 12, 1908. O. E. J.; Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
McKean	: Bradford. D. A. Burnett. (Porter's Catalogue).
Washington	: Linn and Simonton. (Porter's Catalogue).
Westmoreland	: Near Apollo, August 3, 1904. Miss K. R. Holmes; Hillside, May 22, 1909. O. E. J.

3. **Climacium kindbergii** (Renauld and Cardot) Grout.

(*C. americanum* var. *kindbergii* Renauld and Cardot).

(Plate XXXI)

Dark yellowish-green to almost black, usually rather densely cespitose: secondary stems about 3–6 cm. tall, sometimes indistinctly dendroidal, stout, castaneous, bearing along the stem rather scattered widely ovate leaves about 3–4 mm.

long, leaves not sulcate, plane-margined, sub-clasping at base, acute and almost entire at apex, strongly costate into the apex; basal cells in a wide area, rather thin-walled, large, rectangular to rhombic-oblong, often somewhat brownish, above quickly passing into linear prosenchymatous cells about 10–15:1, the apical cells shorter and rhombic oblong; branches densely tufted, ascending to widely spreading, 1.5–2.5 cm. long; branch-leaves about 1.5–2.5 mm. long, broadly lance-ovate, somewhat clasping by the auriculate base with rounded auricles, strongly sulcate, apex obtuse to acute, margin plane, serrate in upper half, strongly costate almost to the apex; median leaf-cells of the branch-leaves oblong-hexagonal, 2–3:1, somewhat incrassate, the basal short rhombic to quadrate-rectangular in the auricles, the median basal longer with rounded ends, incrassate and more or less castaneous-pellucid: sporogonium not seen from our region but described as having the seta more flexuous and considerably longer than in *C. americanum;* capsule 4-6 mm. in length; peristome-teeth perforate.

In swamps and pools in woods from New England to Indiana and the Gulf States. Rare in our region.

Fayette : Along margin of densely shaded mountain stream, Meadow Run Valley, four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

Family XXVI. *LEUCODONTACEAE.*

Dioicous, rarely autoicous: antheridial shoots gemmiform, axillary; archegonial clusters terminal on short perichætial branches; both kinds on secondary shoots: paraphyses few, filiform: plants more or less stiff and robust, laxly cespitose, mostly shining; stem cylindric, central axis rudimentary or none; main stem creeping, branched, radiculose with brownish radicles; secondary stems numerous, erect or ascending, rarely pendent, thickly-leaved, simple or branched; leaves pluri-seriate, decurrent, often plicate, ovate to lanceolate, abruptly to slenderly acute, non-bordered, one-layered; costa double or simple or none; leaf-cells incrassate, mostly smooth, rhombic above, below elongate along the middle of the leaf, towards the margin rounded-quadrate in many series: capsule erect, symmetric, oval or ovate to oblong-cylindric; annulus present; peristome double, teeth lanceolate to lance-subulate, densely articulate, non-bordered, mostly papillose, mostly without projecting lamellæ; basal membrane of inner peristome low, segments rudimentary and narrow or none, as long or shorter than teeth, cilia none; lid conic, obliquely rostrate; calyptra cucullate; spores medium to large.

On rocks and trees, mainly confined to temperate regions: 11 genera; only 2 genera in our region.

Key to the Genera.

a. Costa double or more. 1. *Leucodon.*
a. Costa single. 2. *Forsstroemia.*

1. *LEUCODON* Schwaegrichen.

Dioicous: blackish to yellowish or brownish-green, dull or lustrous: primary stems very long and branched; secondary stems usually simple, equally high, sometimes more or less pinnate, thickly leafy; leaves drying appressed, straight or secund, mostly pluri-plicate, when moist spreading, ovate-acuminate to short-acute, entire or apically serrate, ecostate; median leaf-cells smooth, oblong-rhombic, the basal reddish-yellow; inner perichætial leaves high-sheathing, long-acuminate: seta mostly more or less elongate, reddish; capsule mostly exserted, oblong to oval (or globose), reddish brown to blackish, with a small mouth and short collum, stomata none; annulus present; peristome double with the inner peristome rudimentary or apparently lacking; teeth whitish to yellowish, mostly gaping in the middle or divaricately cleft; lid conic, constricted at the base, sometimes obliquely rostrate; calyptra smooth, cucullate, enveloping the capsule and upper end of seta; spores .025–.035 mm., yellowish-green, finely warty.

A widely distributed genus of 36 species, occurring on trees and rocks; 8 species in North America; 3 species, probably, in our region.

Key to the Species.

a. Leaves plicate; secondary stems well developed: seta about 2–3.5 mm. long, with capsule emergent but shorter than the perichætial leaves. 1. *L. brachypus.*
a. Secondary stems less developed: capsule long-exserted. b.
b. Leaves ovate-elliptic, rather abruptly and shortly acuminate, scarcely plicate. 2. *L. julaceus.*
b. Leaves lance-ovate, long and slenderly acuminate, much plicate. 3. *L. sciuroides.*

1. **Leucodon brachypus** Bridel.

(Plate XXXI)

Moderately robust, brownish to light green, loosely tufted: stems usually at least 5–6 cm. long, with rather numerous secondary simple or branched divisions; leaves about 2 mm. long, ovate, bluntly acute to short-acuminate, obscurely more or less secund, usually plicate with two folds, entire to serrulate above; costa none; median leaf-cells linear-fusiform and castaneous pellucid at base, the interior median rhombic, about 5–8:1, grading to oval at the apex, the marginal basal rounded-quadrate to transversely oblong, all cells incrassate;

perichætial leaves loosely appressed-sheathing, non-plicate, the inner surpassing the capsule: seta about 2–3.5 mm. long, wrapped in the perichætial leaves; capsule oval-oblong, about 1.2–1.5 mm. long, about 2:1, castaneous, small-mouthed, dark-rimmed; lid conic, obliquely short-rostrate; peristome-teeth rather broad, irregular, pale to whitish, papillose, often bifid at apex, the inner peristome very thin, narrow, and without segments or cilia; spores mature in winter or late fall, pale, rather thin-walled, granular.

On trees and rocks in hilly or mountainous regions; from Nova Scotia to Kansas and south to the Gulf States. Rather common in our region.

Cambria : Cresson. T. C. Porter and T. P. James. (Porter's Catalogue).

Crawford : On bark at base of *Fraxinus nigra,* near Linesville, June 11-12, 1907. O. E. J.

McKean : Quintuple, November 11, 1893, (approaching *L. sciuroides* in acumination of leaf-apex) and Langmade, near Bradford, August 11, 1895. D. A. B. (Figured).

Washington : Linn and Simonton. (Porter's Catalogue).

2. **Leucodon julaceus** [Linnæus] Sullivant.

(*Hypnum julaceum* Linnæus; *Pterigynandrum julaceum* Hedwig).

(Plate XXXII)

Resembling the preceding in habit but with shorter secondary stems and distinctly terete branches, which are julaceous when dry: leaves crowded, closely appressed-imbricate when dry, scarcely secund, ovate-elliptic, abruptly short-acuminate, entire or slightly serrulate at apex, the margins often recurved, blade concave, scarcely plicate, the base rounded and sub-clasping; leaf-cells mainly as described for the genus, but the upper much shorter and broader than in the other species, in the median upper third rhombic-oblong, incrassate, about 2–3:1, seriate; the marginal rounded-hexagonal but towards the base usually densely transversely oblong-hexagonal, the basal median linear-vermicular and much incrassate, those above becoming shorter; costa none; perichætial leaves linear-oblong, filiform-acuminate, reaching well up to the capsule: seta slender, partly exserted; capsule turgid-oval, castaneous, about 0.5–0.7×1 mm.; annulus none; lid obliquely short-rostrate, about half as long as the urn; peristome closely similar to that of *L. brachypus,* the teeth apically bifid; spores mature in fall.

In woods on tree-trunks, often mixed with other mosses, from New England to Michigan and south to Florida and Texas. Probably will prove to be not uncommon in our region.

Allegheny : On base of white oak tree, Library, April 29, 1909. O. E. J. (Figured).
Cambria : T. P. James. (Porter's Catalogue).
Indiana : T. P. James. (Porter's Catalogue).
Washington : Linn and Simonton. (Porter's Catalogue).

3. **Leucodon sciuroides** [Linnæus] Schwaegrichen.

(*Hypnum sciuroides* Linnæus; *Fissidens sciuroides* Hedwig).

Rigidly cespitose, brownish to olive-green: secondary stems terete and julaceous, more or less curved-ascending at the ends, usually 3 or 4 cm. long; leaves densely crowded, slightly secund, closely imbricate when dry, more or less open-spreading when moist, lance-ovate, long and slenderly acuminate, entire, usually about 5-plicate, somewhat decurrent; costa none; leaf-cells about as for *L. brachypus;* perichætial leaves pale, non-plicate: seta about 7 or 8 mm. long, rather stout; capsule oblong-elliptic, brown, exserted; lid conic, same color as urn; peristome-teeth slender, pale to whitish, remotely articulate, entire or split towards the base; annulus simple, falling away in fragments; calyptra yellowish-brown apically, reaching to the base of caspule; spores mature in spring but capsules very rarely found.

On trunks of trees, or very rarely on rocks, in woods; Europe, and from lower eastern Canada through the northeastern United States. Not yet found in our region.

2. *FORSSTROEMIA* Lindberg.

(*Leptodon* Mohr).

Autoicous, rarely dioicous; quite robust to slender, green to brownish-green, mostly dull: leaves drying imbricate and non-plicate or indistinctly plicate, when moist erect-spreading, oblong to linear, short acute, also ovate and acuminate, margin more or less revolute, entire or apex serrate; costa rather narrow, ending about the middle; apical and median cells elliptic or oval, the angular rounded-quadrate to transversely oblong; inner perichætial leaves sheathing, long and narrowly pointed, costate or ecostate: seta short, 2–5 mm., straight, red to yellowish; capsule mostly exserted, ovate to oval, pale or reddish-brown; annulus narrow or none; peristome-teeth lance-linear, mostly yellowish, pellucid, densely articulate, finely papillose above, sometimes broken through on the divisural; inner peristome none or very rudimentary: spores .020–.035 mm., yellowish-green, finely papillose; lid conic, narrowly acuminate to shortly rostrate; calyptra cucullate with erect hairs, rarely smooth.

A widely distributed genus of 20 species, mostly arboreal in habitat; 4 species in North America; 1 species in our region.

1. **Forsstroemia trichomitria** (Hedwig) Lindberg.
(*Pterigynandrum trichomitrium* Hedwig; *Leptodon trichomitrius* Mohr).

(Plate XXXII)

Broadly cespitose, rather rigid, yellowish-green; primary stems creeping, filiform, the secondary stems numerous and abundantly branched; leaves close, loosely erect-spreading, lance-ovate, shortly acuminate to acute, entire, when dry somewhat plicate, about 1.5–2 mm. long, the extreme apex rather blunt, the base concave, the margins reflexed; perichætial leaves loose in texture, the inner sheathing, reaching to the base of the capsule or a little higher: seta short, slightly longer than the capsule; capsule ovate-cylindric, thin-walled, rather gradually narrowed below, about 3–4:1, about 1.5 mm. long; exothecial cells rather incrassate, irregularly polygonal to rectangular-oblong, several rows at the narrowed mouth smaller, rounded-quadrate and dark-castaneous; peristome-teeth whitish, lance-linear, rather remotely articulate, sometimes perforate along the divisural, the inner peristome entire to more or less torn, adhering to the ventral surface of the teeth; lid short-rostrate; spores mature in winter, orange-incrassate, almost smooth, about .023–.025 mm.

In woods on trees, rarely on rocks; Asia, and from New England to Ontario and the Gulf States. Common in Eastern Pennsylvania but rare in our region.

McKean : Near Latshaw, N. Y., north of Bradford, August 25, 1895. D. A. B. (Figured).

Family XXVII. *NECKERACEAE.*

Dioicous, rarely autoicous or synoicous; sexual clusters only on secondary shoots and their branches, with filiform, often yellowish paraphyses: slender to robust, mostly stiff, laxly cespitose: stem somewhat dorsiventrally flattened, with or without a rudimentary central strand; primary stem more or less creeping, mostly filiform, mostly sparsely fasciculately radiculose; secondary stems more or less elongate and ascending or much elongated and pendent, mostly distantly or symmetrically pinnate, thickly-leaved, julaceous or flattened; leaves nearly always pluri-seriate, uni-stratose, of various forms; costa mostly delicate, homogenous, simple or double or none; median cells mostly prosenchymatous, the apical sometimes parenchymatous, the basal often colored, the alar sometimes differentiated: capsule mostly erect and symmetric, peristome mostly double, teeth yellowish to brownish, lance-linear, dorsally sometimes abnormally thickened, ventrally trabeculate; the inner peristome with mostly low carinate basal membrane, rarely rudimentary or none, segments linear to filiform, often

fenestrate, rarely cleft the whole length, cilia mostly none; lid conic, erectly to obliquely rostrate; calyptra mitrate to cucullate, mostly hirsute; spores of varying size.

A large family, occurring mainly on trees in warmer regions, often forming a conspicuous part of the vegetation; 51 genera, of which but three occur in our region.

Key to the Genera.

a. Secondary stems flattened, ascending or pendent; leaves mostly conspicuously unsymmetric. b.
a. Secondary stems mostly erect and branched in a tree-like manner; leaves only slightly unsymmetric. 3. *Thamnium.*
b. Exannulate; basal membrane of inner peristome low, cilia none, segments narrowly linear. 1. *Neckera.*
b. Annulus 2-seriate; basal membrane conspicuous, cilia rudimentary and soon disappearing or well-developed, segments about as broad as teeth. 2. *Homalia.*

1. *NECKERA* Hedwig.

Autoicous or dioicous, rarely synoicous: mostly more or less robust, cespitose, green to yellowish or brownish, somewhat lustrous: primary stems often stoloniferous, paraphyllia mostly none; leaves on the filiform shoots small, ecostate, symmetric, concave; normal leaves either 8-seriate, the dorsal and ventral alternately turned to the side, the lateral spreading, or 4-seriate, the dorsal and ventral series lacking, leaves plane, unsymmetric, rugose, more or less spatulate from a broader and shortly decurrent base, acute to obtuse or truncate; costa various; upper leaf-cells rounded to rhombic, the lower linear, the alar differentiated, small and quadrate; perichætial leaves high-sheathing, narrow, long-acuminate: capsule oval or elliptic, immersed to exserted; annulus none; peristome double, inserted far back; peristome-teeth lance-linear, often basally striate, low-trabeculate, sometimes split along the divisural; basal membrane mostly very low; cilia none; calyptra mostly cucullate and with erect hairs; spores medium, mostly brownish, papillose.

A widely distributed genus of about 160 species; about 20 species in North America; two species in our region.

Key to the Species.

a. Leaves narrower, acute to acuminate; capsule at least partly immersed. 1. *N. pennata.*
a. Leaves rounded and abruptly apiculate; capsules exserted. 2. *N. complanata.*

1. **Neckera pennata** [Linnæus] Hedwig.

(*Fontinalis pennata* Linnæus).

Large, with primary stems creeping, often stoloniferous, the secondary stems 6 to 8 or 10 cm. long, erect, pinnate or nearly simple; leaves lance-ovate, acute to acuminate, more

or less undulate above, the margins entire or slightly denticulate; costa short and faint, more or less bi-striate and wrinkled; median leaf-cells linear at base, towards the apex the upper marginal and apical broadly rhomboid; inner perichætial leaves entire, half-sheathing, elongate-lanceolate, reaching somewhat beyond the capsule: seta very short; capsule immersed, yellowish, oblong-oval, brown when old, about 2.5:1; lid acute-conic or acuminate; calyptra very small and covering only the operculum; peristome double, teeth irregularly divided, subulate-linear from a lance-linear base, sometimes apically coherent, the segments rudimentary and very short; spores in summer.

On trees or on moist rocks in cool, moist woods, usually on the trunks of deciduous trees; widely distributed in temperate regions, in North America extending from lower Canada south to North Carolina. Probably rather common in the eastern part of our region.

Cambria : Cresson. T. C. Porter. (Porter's Catalogue).

McKean : D. A. Burnett. (Porter's Catalogue).

2. **Neckera complanata** [Linnæus] Huebener.

(*Hypnum complanatum* Linnæus; *Homalia complanata* De-Notaris).

Yellowish to pale green, in rather large and dense tufts, soft: stems long, often reaching 8 or 10 cm., branchlets pinnately arranged; complanate, sometimes more or less flagelliform; leaves oblong-lingulate, compressed, complanate, usually rounded at the apex and short-apiculate, sometimes acute or acuminate, those at the tips of the branches often more or less deflected and falcate, the margin usually inflexed at base on one side, serrulate at apex; costa double, very short and faint, or none; median leaf-cells linear-vermicular, the apical shorter and wider, rhomboidal, the angular quadrate-oval and yellowish-pellucid; perichætia borne along the sides of the stem, the leaves long-sheathing: seta yellow, about 1 cm. long; capsule oval to elliptic-oblong, pale, orange-yellow or castaneous, about 2:1, small-mouthed; lid subulate-rostrate, usually oblique; calyptra cucullate, reaching to about the middle of the urn; peristome-teeth long, pale, narrow, the segments about half as long, filiform from an enlarged base; spores mature in spring but capsules rarely produced.

On bark of trees, rarely on rocks; Europe, Asia, northern Africa, and from Labrador to Tennessee. Rare in our region. Reported from "Allegheny Mountains in Pennsylvania" in Lesquereux and James' Manual.

2. *HOMALIA* (Bridel) Bryologia Europæa.

Dioicous or autoicous: slender to robust, in wide, more or less lustrous, dark colored, matted tufts: primary stems with stolons; secondary stems mostly irregularly dichotomous, non-flagellate; leaves 4-seriate, complanately spreading, unsymmetric, spatulate to lingulate from a slightly decurrent base, rarely rounded, obtuse, non-bordered, with apex entire or serrulate; costa simple, incomplete or none; upper leaf-cells rounded to hexagonal, lower elongate, at least the median so, rarely all linear; inner perichætial leaves, short-sheathing, lanceolate, acute; seta long, mostly smooth; capsule mostly erect to cernuous, oblong from a narrowed base, when old sometimes arcuate, red-brown, rarely almost pendent and short-oval; annulus 2-seriate; peristome double, inserted at the mouth; teeth linear-subulate from a broader base, yellow to brownish, apically hyaline, mostly transversely striate and with well-developed lamellæ; inner peristome yellow, papillose, basal membrane high, carinate, segments longer and almost as broad as the teeth, broken through in places along the keel, cilia mostly rudimentary and fugaceous, sometimes well-developed and appendiculate: lid conic, obliquely rostrate; calyptra cucullate, mostly glabrous; spores small, brownish.

About 60 species on trees, rocks, and stones, mostly in temperate regions; 7 species in North America: one species in our region.

1. **Homalia jamesii** Schimper.

In straggling tufts, shining yellow-green, repeatedly distichous, stoloniferous: stems slender, interruptedly foliate by the numerous innovations; the branches strongly complanate-foliate; leaves cultriform, sub-falcate, oblong, obtusely apiculate, minutely serrulate above the middle, striolate lengthwise when dry; costa faint, slender, reaching half-way or more; lower median leaf-cells linear-fusiform, the apical and marginal about 1.5–1:1, about as broad as long, rhomboidal: seta about 1.5 cm. long, slender; capsule erect to cernuous, oblong-cylindric, about 2.5:1, symmetric, when dry scarcely constricted below the mouth; peristome double, teeth long, yellowish, confluent at base, inner peristome about as long as the teeth, the segments narrow, sub-linear, more or less carinately perforate, cilia rudimentary and solitary or none; annulus present; spores mature in fall but capsules rarely found.

On rocks and in crevices, in mountainous or hilly districts; from Newfoundland and Nova Scotia to Pennsylvania, also in Washington State. Possibly will be found to occur in the eastern part of our region.

3. *THAMNIUM* Bryologia Europæa.
(*Porotrichum* Bridel).

Dioicous or, rarely, autoicous: mostly robust to very robust, with a long, creeping primary stem: the primary stem has scale-like leaves, and is more or less densely brown-radiculose; the secondary stem erect to ascending, without branches below, stoloniferous, somewhat dendroid in habit; branches spreading, flattened, obtuse; leaves erect-spreading to spreading, plane to concave, smooth to plicate, not rugose, non-decurrent, unsymmetric, mostly oblong to ovate or ovate-lingulate, the apex obtuse to acute, serrate; costa strong, mostly incomplete; median leaf-cells parenchymatous, the basal sometimes linear; inner perichætial leaves lanceolate-acuminate and spreading from a half-sheathing base: seta various, mostly 10–15 mm. long, in certain species not more than 4 mm., in others up to 4 cm. long, red, smooth; capsule inclined to horizontal, arcuate, gibbous, rarely erect, symmetric, and oval; annulus revoluble; peristome-teeth lanceolate to linear, subulate-acuminate, yellowish, bordered, with a zigzag divisural; inner peristome pale yellow, basal membrane prominent, segments broad, carinately split and gaping; cilia often appendiculate; spores small; lid conic, rostrate; calyptra cucullate, glabrous.

About 41 species in temperate and warm regions; 7 species in North America; one species in our region.

1. **Thamnium allegheniense** (C. Mueller) Bryologia Europæa.
(*Hypnum allegheniense* C. Mueller).

(Plate XXXII)

Large, dendroidal in habit, bright to pale green, usually rising to a height of 4–7 cm.; leaves of the branches and branchlets up to 3 or 3.5 mm. long, rather lustrous and sub-plicate when dry, erect-spreading, oblong-elliptic, short-pointed, concave, the base somewhat narrowed but scarcely concave, the apex broadly acute, the plane margin strongly serrate above; costa strong, extending to near the apex; leaf-cells incrassate, the median shortly rounded- or rhomboid-hexagonal, about 2:1, the basal becoming elongate-oblong, varying to elongate-rectangular, the lower marginal and angular, scarcely wider but sub-rectangular to quadrate; perichætial leaves erect, sheathing, narrowly acuminate, ecostate: seta lustrous, of a rich castaneous color, usually about 1 cm. long, smooth, arcuate; capsule oblong-cylindric, castaneous and rarely somewhat wrinkled when dry, about 2–2.5:1, about 2 to 2.5 mm. long, nearly symmetric but by the curving of the pedicel inclined or horizontal, sometimes curved; lid conic, long- and stout-rostrate, the whole lid being about one-half to one-third as long as the urn; peristome normally hypnoid, large; teeth lance-sub-

ulate, distinctly but finely cross-striate in at least the lower half, hyaline and papillose above, castaneous-pellucid below, the dorsal lamellæ and the divisural distinct, the trabeculæ well developed; segments papillose, pale yellowish, about as long as teeth, cleft carinately between the articulations; basal membrane one-third as high as teeth; cilia 2–3, sub-appendiculate, almost as long as segments; annulus narrow, revoluble, simple; spores mature in late fall or early winter, smooth, castaneous-pellucid, medium-walled, about .016–.018 mm.

On dripping rocks and ledges along streams in the hills or mountains from Nova Scotia to Minnesota and south to the Gulf States.

Cambria	: Cresson. T. P. James. (Porter's Catalogue).
Huntingdon	: T. C. Porter. (Porter's Catalogue).
McKean	: On stones in or at the edge of streams, Hedge-hog Hollow, March 18, 1894, Bennett Brook, April 9, 1893 (Figured), and Limestone Creek, N. Y., all near Bradford.

Family XXVIII. *ENTODONTACEAE.*

Autoicous or dioicous: slender to quite robust, mostly stiff, laxly cespitose, mostly lustrous; central strand none or but few-celled; stem thickly-foliate, julaceous or complanate; leaves pluri-seriate, uni-stratose, often unsymmetric; costa delicate, homogeneous, never complete, or double and very short, or none; leaf-cells mostly prosenchymatous, the alar differentiated, being quadrate or transversely widened: capsule exserted, mostly erect and symmetric, never plicate; peristome mostly double, the inner rarely lacking; teeth yellow to castaneous, with divisural, trabeculate, mostly papillose; segments narrow or lance-subulate, often split carinately, the basal membrane low, carinate, the cilia rudimentary or none; spores mostly small; lid conic, short- to long-rostrate; calyptra cucullate, glabrous.

Mostly in warmer and temperate regions, on trees, sometimes on rocks or on soil: 19 genera, 5 genera in our region.

Key to the Genera.

a. Leaf-cells smooth. b.
a. Leaf-cells more or less strongly papillose. d.
b. Leaves narrowed at base, lower margins revolute. 2. *Entodon.*
b. Leaves not narrowed at base. c.
c. Basal membrane of inner peristome almost none: leaves acute, their margins revolute far above the base; branches when dry not strongly curved at the end. 3. *Platygyrium.*

c. Basal membrane more or less prominent: leaves acuminate, margins plane; branches when dry strongly curved at the apex. 4. *Pylaisia.*

d. Branches complanate-leaved: peristome segments broad, and as long as the teeth. 1. *Schwetschkeopsis.*

d. Branches julaceous: segments filiform or rudimentary. 5. *Pterygynandrum.*

1. *SCHWETSCHKEOPSIS* Brotherus.

Dioicous or autoicous: slender, stiff, forming flat tufts, green to yellowish-green: stem long, creeping, radiculose, mostly densely and symmetrically pinnately branched; branches densely complanately-leaved, obtuse, short to long, ascending, simple or branched; paraphyllia few, lanceolate or orbicular, rarely filiform; branch-leaves when dry imbricate, when moist erect-spreading, non-decurrent, concave, plicate, lance-ovate, acuminate to subulate-pointed, serrulate, plane-margined; costa none; leaf-cells oblong-hexagonal, dorsally papillose above, alar quadrate and numerous, chlorophyllose: seta up to 7 mm. long, slender, tortuous, yellowish-red, smooth, when dry twisted; capsule mostly erect and symmetric, shortly collumate; exannulate, peristome double, teeth lanceolate, yellow, with zigzag divisural, densely transversely striate, closely trabeculate; inner peristome hyaline, basal membrane one-third as high as teeth, smooth, segments about as long as teeth, broad, split along keel, finely papillose, cilia rudimentary; spores about .015 mm.; lid obliquely rostrate.

Three species, on trees: one in Japan and Korea, one in Nepal, and the following:

1. **Schwetschkeopsis denticulata** (Sullivant) Brotherus.
(*Leskea denticulata* Sullivant).

(Plate XXXII)

Light green, soft, silky: stems usually 2–3 cm. long, sometimes more, irregularly branched, paraphyllia none; stem-leaves erect-spreading, close, concave, ovate, somewhat decurrent, abruptly and narrowly acuminate, 0.4–0.9 mm. long, 0.3–0.4 mm. wide, plane-margined, sometimes slightly striate, marginally undulate-denticulate; ecostate; apical leaf-cells dorsally uni-papillate, the median oblong-oval to elongate-rhomboidal, sometimes vermicular, about 4–8:1, about .005–.008 mm. wide, the marginal uni-seriate and curvi-linear, the alar forming a small group of quadrate incrassate cells; branch-leaves smaller and less abruptly acuminate, with more oblong and shorter cells: seta yellowish-red, slender, tortuous, erect; capsule erect or nearly so, oblong, about 2–3:1; operculum conic-rostrate, about two-thirds as long as the urn; peristome about the same width as the teeth; no cilia; no annulus; fruit rarely found.

Mostly on bases of trees, rarely on rocks, occurring in Asia and from Connecticut to the Mississippi River and south to Florida. Apparently rare in our region.

McKean : Lewis's Run, Bradford, November 24, 1895, and Limestone Creek, Bradford, December, 1896. D. A. B. (Figured). The latter issued as Grout's No. 134, North American Musci Pleurocarpi.

2. *ENTODON* C. Mueller.

Autoicous, rarely dioicous: green to golden-brown: stem prostrate to ascending, complanate-leaved, rarely julaceous, thickly pinnately branched, mostly short, simple, ascending or spreading; stem-leaves compressed, slightly decurrent, concave, the dorsal and ventral imbricate, the lateral spreading, oval, from an ovate base obtuse or apiculate or rarely slenderly acuminate, entire or apically serrate; costa double and very short, or none; leaf-cells narrowly linear, smooth, the basal lax and incrassate, the alar laxly quadrate, forming a distinct hyaline group: seta mostly 1–3 cm. long, red or yellow, twisted when dry; capsule erect, straight or weakly curved; collum short; annulate or exannulate; teeth inserted below the mouth, lance-linear, acuminate, thin, plane, mostly non-margined, orange to castaneous, distantly articulate, mostly low-trabeculate; inner peristome without prominent basal membrane, segments linear, carinate, yellow, as long as or shorter than the teeth, cilia none; spores .012–.020 mm.

Nearly 150 species, on trees and on calcareous rocks, in temperate and warmer regions; about 33 species occurring in North America; 4 or 5 species in our region.

Key to the Species.

a. Leaves narrowly gradually acuminate. (*E. brevisetus* (H. and
a. Leaves acute or abruptly acuminate-apiculate. W.) Jaeg.)
b.
b. Leaves entire or almost so; only the alar cells quadrate or rectangular.
c.
b. Leaves serrulate; all basal cells rectangular.
(*E. sullivantii* (C. M.) Lindb.).
c. Teeth with more than twenty articulations: leaves acute, but not apiculate. 1. *E. compressus.*
c. Teeth with less than twenty articulations.
d.
d. Leaves acuminate-apiculate: teeth 15–20-articulate: capsule less than 4.5:1. 2. *E. cladorhizans.*
d. Leaves abruptly apiculate: teeth less than 10-articulate; capsule about 5:1. 3. *E. seductrix.*

1. Entodon compressus C. Mueller.

(*Cylindrothecium compressum* Bryologia Europæa).

Widely and flatly cespitose, glossy yellow-green, with much-compressed stems and branches: considerably more slender than

E. cladorhizans but quite similar in general appearance: leaves about 1.0–1.1×0.4–0.5 mm., quite concave, broadly oblong-ovate, obtuse, entire at apex; median leaf-cells linear, the alar quadrate and numerous; costa none or very rudimentary: seta erect, long; capsule erect, short-ovate to elliptic, narrow-mouthed, about 2.5×0.6 mm.; lid rather long and with a slender curved rostrum; annulus large, early deciduous; peristome-teeth long, lance-linear, closely articulate, the segments somewhat shorter, linear-subulate, free from the teeth, the teeth densely papillose above; spores mature in fall or early winter.

On bases and roots of trees in moist situations, often near water-courses; northern Europe, Asia, and, in the United States from Missouri to Pennsylvania and southwards. Apparently rare, or entirely absent from our region, but occurs in Ohio and in Eastern Pennsylvania.

2. **Entodon cladorhizans** (Hedwig) C. Mueller.

(*Cylindrothecium cladorhizans* Schimper; *Neckera cladorhizans* Hedwig).

(Plate XXXII)

Cespitose in wide tufts, brightly lustrous, yellowish-green: stems compressed, somewhat pinnately branched, rather acuminate and sometimes up-curved at the apex; branches complanate and spreading widely from the stem, more or less acuminate to attenuate at the apex, where sometimes rooting; leaves loosely imbricate, very concave, non-plicate, narrowed at the apex, margin plane or narrowly revolute below, apex sub-acute, faintly serrulate, usually turned slightly backwards; leaves ovate to oblong, about 1–2 mm. long by one-half as wide; costa double, short and indistinct, or none; median leaf-cells long-linear, prosenchymatous, smooth, with firm and hyaline walls, the alar hyaline to somewhat reddish, incrassate, quadrate-rectangular in a triangular patch of 6–8 rows depth, bordered by a few intermediate, sub-quadrate to sub-vermicular cells, the apical cells shorter and rhombic: seta erect, smooth, sinistrorse, rich castaneous in color, lustrous, about 8–12 mm. long; capsule about 4–6:1, oblong-cylindric, tapering abruptly to the seta, smooth, not sulcate when dry, castaneous, narrowed somewhat at the mouth, 2.5–3.5 mm. long; annulus early deciduous, large, pulri-seriate with incrassate quadrate cells; exothecial cells yellowish with thin walls, rectangular to oblong, towards the rim suddenly much smaller and incrassate, more or less laterally oblong under the annulus; operculum conic-rostrate, about 0.4–0.6 mm., long, often apiculate; peristome double, deeply inserted, teeth light-castaneous, about 16–20-articulate, below lightly papillose-striate in variously divergent or radiating lines, not finely transversely striate as in

most hypnaceous peristomes, sometimes perforate, (lacunose) above; segments distinct, linear, very narrow, carinate, hyaline, very slightly granulose-roughened, entire, nearly as long as the teeth, arising from a very narrow basal membrane; cilia none; spores papillose, incrassate, castaneous, about .016–.020 mm., mature in late autumn or early winter.

On leaf-mould, rotting logs, bases of trees, etc.; Europe, and, in America, from New Brunswick to Ontario and south to the Gulf States. Common in our region.

Allegheny	: Wildwood Road Hollow, March 29, 1909. O. E. J. and G. K. J. (Figured); 33 other pockets from various localities in the county.
Beaver	: T. P. James. (Porter's Catalogue).
Butler	: Valencia, September 27, 1904. O. E. J.
Crawford	: Linesville, August 3, 1909. O. E. J.
Indiana	: T. P. James. (Porter's Catalogue).
Fayette	: Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
Lawrence	: Gorge below Ellwood City, October 14, 1910. O. E. J. and G. K. J. (Figured).
McKean	: Quintuple, June 15, 1896. D. A. B.
Washington	: Linn and Simonton. (Porter's Catalogue).
Westmoreland	: Shades, near Blackburn, March 25, 1910. O. E. J. and G. K. J.

3. **Entodon seductrix** (Hedwig) C. Mueller.
(*Neckera seductrix* Hedwig; *Cylindrothecium seductrix* Sullivant).

(Plate XXXIII)

Robust, widely cespitose in glossy yellowish-green mats: branches sub-pinnately arranged, slender, julaceous, up to 2 or 2.5 cm. long; leaves about 0.8–1.4 mm. long, broadly oblong-ellipitic to ovate, imbricate, deeply concave, short-apiculate with the apiculation often reflexed, margin plane, entire, or sometimes slightly serrulate, at base often slightly reflexed, base of leaf slightly narrowed; costa short and double; median leaf-cells linear- to oblong-prosenchymatous, alar cells quadrate, slightly incrassate, forming a distinct group sometimes extending along the margin for one-fourth the length of the leaf; perichætial leaves with a slender acumen, narrower and reaching a length of about 3 mm.: seta glossy, red-castaneous, erect, sinistrorse, about 1.5 cm. long; capsule 2–3 mm. long, castaneous, about 5–6:1, cylindric, erect, symmetric or slightly curved; exothecial cells yellowish with medium walls, rectangular to irregularly oblong, towards the rim smaller, quadrate to laterally oblong incrassate, and forming a rather indefinite

annulus of 2 or 3 series; peristome-teeth few-articulate above, deeply inserted, lance-linear, rather short, bordered, not transversely striolate but irregularly papillose, dorsal lamellæ and divisural strongly marked; segments nearly as long as teeth, narrowly linear-carinate, free from teeth, arising from a very narrow basal membrane, smooth, cilia none; operculum conic-rostrate, usually somewhat oblique, about 0.5–0.8 mm. long; calyptra small, enclosing only about half of the capsule; spores yellowish-incrassate, about .014–.018 mm. in diameter, minutely roughened, mature in late summer. Variable.

On rotten logs, earth, rocks, roots of trees, etc.; from New England to Minnesota and south to the Gulf States. Common in our region.

Allegheny	: Guyasuta Hollow, October 25, 1908, and Keown, November 14, 1909. O. E. J.
Crawford	: Linesville, May 12, 1908. O. E. J.
Erie	: Presque Isle, September 20-22, 1906. O. E. J.
Fayette	: Ohio Pyle, September 1-3, 1906, and Cheat Haven, September 1-3, 1910. O. E. J. and G. K. J.
Huntingdon	: Huntingdon, July 20, 1908. O. E. J.
Indiana	: T. P. James. (Porter's Catalogue).
McKean	: Shepherd's Run, August 17, 1895. D. A. B.
Washington	: Charleroi, October 13, 1906. O. E. J. and G. K. J. (Figured).

3a. **Entodon seductrix** variety **minor** (Austin) Grout.

Differs from the type in size, being only about one-half to two-thirds as large, usually darker in color: capsule about 3–4:1, about 2–2.5 mm. long; spores usually about .010–.015 mm. in diameter.

Allegheny	: Bark of decaying log, mixed oak and pine woods, Dutil Church, Douthett, December 29, 1908. O. E. J.

3. *PLATYGYRIUM* Bryologia Europæa.

Dioicous, rather robust, flatly cespitose, green to golden or brownish-green, lustrous: stem elongate, creeping, ventrally densely radiculose, thickly-leaved and unsymmetrically pinnate; branches julaceous, mostly short, simple; leaves imbricate when dry, moist spreading, decurrent, non-plicate, ovate to oblong-lanceolate, sharply acute, smooth, margins revolute; ecostate; apical cells rhomboid, linear below, alar quite large, numerous, quadrate; seta 8–15 mm., sometimes 20 mm., smooth, castaneous: capsule erect, symmetric or slightly arcuate, narrowly oblong to almost cylindric; annulus broad, pluri-seriate, revoluble entire or sometimes in pieces; peris-

tome inserted on the mouth, double; teeth lance-linear, yellow, broadly bordered, non-striate, trabeculæ thickened; basal membrane not prominent, segments narrowly linear, carinately cleft, cilia none; spores .012–.018 mm., lid conic, shortly and obliquely rostrate.

A widely distributed genus of about 11 species: one species in North America.

1. **Platygyrium repens** [Bridel] Bryologia Europæa.

(*Pterogonium repens* Schwaegrichen; *Anomodon repens* Fuernrohr; *Cylindrothecium repens* DeNotaris; *Entodon repens* Grout).

(Plate XXXIII)

Densely but thinly matted, bright to dark green, pinnately branching: leaves ecostate, crowded, erect-spreading when moist, imbricate when dry, concave, subscarious, lustrous, ovate to long-lanceolate, about 0.7–0.9 mm. long, acuminate, the margin entire and recurved below; leaf-cells all medium-walled, at apex rhomboidal, the median linear-rhomboidal prosenchymatous, about 6–9:1, the alar distinct, quadrate and relatively large, extending up the margin; inner perichætial leaves about twice as long as the branch-leaves, ecostate, more acuminate: seta erect, 10–15 mm. long, smooth, lustrous, dark-castaneous, sinistrorse; urn of capsule about 1.0–1.2 mm. long, erect, symmetric, oblong-cylindric, castaneous, not narrowed below the mouth when dry; operculum about two-fifths the length of the urn, slenderly and obliquely but bluntly rostrate; annulus persistent, large, 2–3-seriate, and appearing like modified upper exothecial cells; peristome-teeth rather deeply inserted, linear-lanceolate, light yellowish-brown, strongly about 15–18 trabeculate, widely hyaline-bordered, papillose below in irregular and often radiating lines, but not cross-striate below as in most hypnaceous peristomes, lamellæ and divisural line rather indistinct; segments about two-thirds as long as teeth, linear, narrow, arising from a very low basal membrane, more or less carinately cleft; cilia none; exothecial cells quadrate to irregular or oblong-hexagonal, yellowish; spores about .014–.018 mm., yellowish, minutely roughened, medium-walled, mature in autumn; gemmæ often abundant in the axils of the upper leaves.

On bark at base of trees, on decaying logs, stumps, and in woods; widely distributed in the Northern Hemisphere; in North America from New Brunswick to the Pacific and south to the Gulf of Mexico. Very common in our region.

Allegheny : More than 40 pockets from various localities in the county, 1905-1911, mostly O. E. J. and G. K. J.; on rotten log in oak

woods, Keown, November 14, 1909. O. E. J. (Figured).

Armstrong : Kittanning, September 24, 1904. O. E. J. and October 21, 1905. O. E. J.

Beaver : T. P. James. (Porter's Catalogue).

Butler : Near Crider's Corners, December 29, 1908. O. E. J.

Crawford : Bark of Chestnut tree, Linesville, May 12, 1908. O. E. J.

Greene : Waynesburg, October 17, 1905. O. E. J.

Fayette : Four miles south of Ohio Pyle, Morris Farm, September 1-3, 1906. O. E. J. and G. K. J.

McKean : Bradford. D. A. B. (Porter's Catalogue).

Washington : Linn and Simonton. (Porter's Catalogue); Hanlin, on base of *Juglans nigra*, May 21, 1908, and on log, Library, Pa., April 22, 1906. O. E. J.

Westmoreland: On bark of dead tree Laurel Hill Mts., Mellon's estate, September 8-11, 1907. O. E. J.; Shades, near Blackburn, March 25, 1910. O. E. J. and G. K. J.

4. *PYLAISA* Bryologia Europæa.

(*Pylaisiella* Kindberg).

Autoicous; slender to rather robust, lustrous, in flat tufts: stem creeping, long, unsymmetrically pinnate; branches short, ascending to erect, often curved, in cross section appearing appressed; leaves homogeneous, more or less imbricate, when moist erect-spreading, often secund, somewhat decurrent, concave, non-plicate, ovate to lance-oval, more or less long-acuminate, mostly plane and entire; costa double, very short or none; leaf-cells linear-rhombic, smooth, alar numerous, quadrate: seta 1–2 cm. long, castaneous, drying twisted, smooth; capsule erect, symmetric, rarely somewhat curved, oval to oblong-cylindric, collum short; annulus small-celled or none; peristome deeply inserted; teeth lance-subulate, at the apex often irregular and sometimes remaining in the lid or attached to the segments, yellowish, hyaline-bordered, striate, densely articulate and trabeculate; basal membrane low, segments narrowly lance-subulate, as long as the teeth or shorter, sometimes two-cleft, the divisions remaining attached to the teeth; cilia mostly rudimentary; spores small to large; lid conic to rostrate.

Thirty-seven species, mainly on trees, in temperate regions; 11 species in North America, probably four species in our region.

Key to the Species.

a. Segments completely adherent to the teeth. 1. *P. intricata.*

a. Segments free, at least in the upper third. b.

b. Annulus 2–3-seriate, large-celled; spores about .017–.024 mm. 2. *P. schimperi.*

b. Annulus uni-seriate; spores .010–.016 mm. c.

c. Operculum rostrate; cilia none; spores .009—.012 mm. 3. *P. subdenticulata.*

c. Operculum merely conic; cilia single, short or rudimentary; spores .012–.016 mm. 4. *P. polyantha.*

1. **Pylaisia intricata** (Hedwig) Renauld and Cardot.

(*P. velutina* Bryologia Europæa; *Pylaisiella velutina* Kindberg; *Pterygynandrum intricatum* Hedwig).

(Plate XXXIII)

Similar in appearance to *P. schimperi*, with which it often is confused and with which it grows, light-green, glossy, in closely entangled mats: branches ascending or erect, when dry usually more or less hooked at the end; leaves lanceolate, long-acuminate, usually falcate-secund, about 0.8–1.2 mm. long, about 0.2–0.3 mm. wide; leaf-cells similar to those of *P. schimperi* but with a smaller group of incrassate, quadrate, obscure alar cells; median leaf-cells about 6–10:1, sub-vermicular, about .004–.005 mm. wide; costa none: seta straight, smooth, about 4–5 mm. long; capsule ovoid-cylindric, about 2 mm. long, erect, symmetric, castaneous; lid long-conic, about 0.5 mm. long; peristome-teeth closely trabeculate, dorsally distinctly lamellate and with divisural, finely cross-striate; segments very delicate, split and adherent to the teeth throughout their whole length, basal membrane indistinct or none; spores densely incrassate, castaneous-pellucid, finely papillose, in our specimens about .018–.030 mm. in diameter, mature in late fall.

On bases of trees or on stumps, usually in mountainous or hilly regions; Newfoundland to Ontario, south to North Carolina. Rare in our region.

McKean : Bennett Brook, October 23, 1897, and Limestone Creek, near Bradford, October to December, 1896. (Figured). The latter mixed with Grout's No. 134. North American Musci Pleurocarpi.

2. **Pylaisia schimperi** Cardot.

(*P. intricata* Bryologia Europæa; *Pylaisiella intricata* Grout).

(Plate XXXIII)

In thin, densely interwoven mats, dark-green, glossy; rather closely and regularly pinnate: branches more or less ascending to erect, usually about 3–4 mm. long, when dry de-

cidedly curved or hooked at the end; leaves close, imbricate at the base, prominently falcate-secund, especially so when dry, lance-ovate, about 0.7–1.0 mm. long by about one-third as wide, rather long-acuminate, sub-serrate to entire, rounded at the base, concave, the margin plane and non-bordered; median leaf-cells about 6–10:1, usually .003–.004 mm. wide, linear-prosenchymatous, the apical shorter and wider, the alar distinct, numerous, quadrate to transversely rectangular, yellowish-incrassate, forming a triangular group extending up along the leaf-margin to one-third the length of the leaf; perichætial leaves similar but longer, up to 2.5 mm., and more slenderly acuminate: seta about 1.5 cm. long, lustrous, red-castaneous, dextrorse above; capsule ovoid-oblong, castaneous, about 2 mm. long, about 2.5:1, erect, symmetric, small-mouthed; peristome-teeth narrowly triangular lanceolate, closely trabeculate, the dorsal lamellæ narrow, numerous, finely cross-striate, pale yellow, bordered up to two-thirds or three-fourths by the linear, adherent, hyaline and somewhat papillose segments, which are usually united at the tip but widely split below; cilia none; basal membrane very narrow or none; annulus 2–3-seriate, narrow; exothecial cells yellowish, somewhat incrassate, irregularly rounded-hexagonal to oblong-rhomboidal, below the annulus several series being much smaller and transversely rhomboid-oblong; lid about 0.5 mm. high, conic-obtuse, often somewhat oblique; spores densely chlorophyllose, densely incrassate, castaneous-pellucid, papillose, about .018–.025 mm., mature in September or October.

Allegheny	: Power's Run, September 21, 1905. O. E. J.
Clearfield	: Phillipsburg. T. P. James. (Porter's Catalogue).
Elk	: McMinn. (Porter's Catalogue).
Indiana	: Blairsville. T. P. James. (Porter's Catalogue).
Fayette	: Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J. (Figured).
Lawrence	: Gorge below Ellwood City, June 26, 1909. O. E. J.
McKean	: D. A. B. (Porter's Catalogue).
Washington	: Linn and Simonton. (Porter's Catalogue).
Westmoreland	: Shades, near Blackburn, March 25, 1910. O. E. J. and G. K. J.

3. **Pylaisia subdenticulata** Bryologia Europæa.

(*Pylaisia denticulata* Sullivant).

Intricately cespitose, glossy, yellow-green: stems creeping with erect or ascending branches about 5–6 mm. long;

branch-leaves subfalcate, secund, erect-spreading to imbricate when dry, lance-ovate, entire below, sub-denticulate above, acuminate, concave, ecostate or faintly costate at base; leaf-cells linear-rhomboidal, 6–8:1, quadrate alar cells numerous, incrassate, extending up the margin: seta short, erect; capsule oblong, about 2.5–3.5 mm. long, about 3–4:1, erect; lid shortly rostrate; annulus narrow; peristome-teeth lance-linear, segments free, basal membrane distinct, cilia none; spores about .008–.012 mm. in diameter, mature in autumn.

On bases of trees and on rocks, in woods, from New England to Illinois, south to the Gulf States and to New Mexico. Not yet found in our region.

4. **Pylaisia polyantha** [Schreber] Bryologia Europæa.

(*Leskea polyantha* Hedwig).

Intricately matted, yellowish-green: stems prostrate, rooting on bark, not stoloniform, up to 6 or 8 cm. long, with numerous erect or ascending, curved branches about 0.5–1 cm. long; branch-leaves erect and secund or pointing upwards, when dry loosely imbricate, small, lanceolate, rapidly narrowed into a tapering acumination of about same length as the body of the leaf, entire, slightly concave, non-plicate, plane-margined, ecostate or with a very short and faint double or single nerve; median leaf-cells thin-walled, about 6–10:1, the alar few, quadrate, pellucid, rather broad and distinct; stem-leaves somewhat broader and more abruptly acuminate: seta about 1.5 cm. high; capsule oblong-cylindric, about 3.5–4:1, about 2.5 mm. long; lid conic, acute, short; annulus single, narrow; peristome-teeth lance-linear, closely articulate, somewhat granular above, segments about as long as teeth, lance-linear, granulose, somewhat split when old; spores mature in fall or winter, about .012–.016 mm.

On tree trunks and in hedges, etc.; Europe, Asia, and in lower Canada and the northeastern United States. Apparently rare in our region.

McKean : Bradford. D. A. Burnett. (Porter's Catalogue).

5. *PTERYGYNANDRUM* Hedwig.

Dioicous; slender to quite robust, variously cespitose, green to yellowish-green, dull or lustrous, primary stem stolon-like, irregularly radiculose; secondary stems secund, filiform-julaceous, the base stolon-like, radiculose, often flagelliform, densely-leaved, ascending, forked, bushy or pinnately branched; leaves imbricate, sometimes secund, somewhat decurrent, non-plicate, deeply concave, ovate to oval, short-acute to subulate-acuminate, margins narrowly revolute to the middle or above, entire or serrulate upwards; costa usually

very short and thin, forked or double, rarely single and reaching to the middle of the leaf; cells narrow to rhombic-hexagonal, strongly and sharply dorsally papillose, basal cells wider and longer, alar quadrate in several series; inner perichætial leaves thin, broadly lanceolate, sheathing, acute, the margins entire and plane: seta 8–15 mm. long, red or yellow-red, drying twisted; capsule erect, mostly symmetric, cylindric, yellow to brown; annulus 2-seriate, narrow; peristome inserted near the mouth; teeth lanceolate, confluent at the base, yellowish, below transversely and obliquely striate, above smooth, distantly articulate, non-trabeculate; inner peristome hyaline, smooth, with quite low basal membrane, the segments very narrow, short, or sometimes almost as long as the teeth; cilia none; spores .010–.018 mm.; lid conic, shortly and mostly bluntly rostrate.

Only two species: *P. papillosum* in British Columbia, and the following:

1. **Pterygynandrum filiforme** [Timm] Hedwig.

(*Leskea cylindrica* Bridel).

On bases of trees and on rocks, in woods, widely distributed in the Northern Hemisphere,—in North America, extending from Greenland to British Columbia and southwards to the northern United States. Occurs in the Pocono region of Eastern Pennsylvania and, possibly, will be found in the northern or northeastern part of our region.

The generic description will readily enable one to differentiate this species from other mosses in our region.

Family XXIX. *FABRONIACEAE.*

Autoicous or dioicous: slender to very slender, weak, cespitose, mostly bright or light green, mostly lustrous: stem without central strand, weak, creeping, thin, with red, fasciculate radicles; the secondary stems densely-leaved, simple or branched, erect; leaves 5–8-seriate, drying appressed, spreading when moist, rarely secund, more or less concave, unistratose, non-decurrent, ovate to lanceolate, non-bordered, non-plicate; costa simple, delicate and short; rarely ecostate; median leaf-cells mostly prosenchymatous, smooth, mostly thin-walled, towards the basal angles quadrate to rectangular: capsule exserted, erect, symmetric, oval to sub-cylindric, drying often longitudinally wrinkled and constricted below the mouth, the collum short and thick; peristome deeply inserted, single or double; teeth plane, distantly articulate, non-lamellate, in our genera non-bordered, teeth rarely none; inner peristome none or consisting generally of subulate segments; lid broad, mostly conic and rostrate; calyptra cucullate, naked, smooth, small, fugaceous; spores small.

A family of 11 genera, mostly occurring on tree-trunks in warm regions; only two genera within our range.

Key to the Genera.

a. Inner peristome none; teeth short, broad, and blunt. 1. *Fabronia.*
a. Peristome double; teeth broadly lanceolate. 2. *Anacamptodon.*

1. *FABRONIA* Raddi.

Autoicous, rarely dioicous: stem creeping, partly stoloniform, rarely erect, irregularly branched; branches often partly stoloniform and partly leafy; leafy branches thickly julaceous, the leaves often drying imbricate, sometimes secund, ovate to ovate-lanceolate, mostly subulate-acuminate or piliferous, entire to serrate or even ciliate-laciniate; costa mostly delicate and short, sometimes indistinct; median leaf-cells elongate-rhomboid to elongate-hexagonal, the alar quadrate in several series, sometimes not differentiated; inner perichætial leaves sheathing, subulate-acuminate, ecostate: seta mostly 1–7 mm. long, thin, pale yellow, smooth, drying twisted; capsule erect, symmetric, ovate to pyriform, with a short neck, drying plicate, the collum shrinking and the capsule becoming cup-shaped to hemispheric, light brown, wide-mouthed; annulus none; peristome simple, rarely none, teeth very hygroscopic, at first united in pairs, later separating, broad, obtuse, often cleft or perforate divisurally, brown, non-bordered, longitudinally striate--papillose, non-trabeculate; lid conic-convex to low convex, mostly short-rostrate.

A genus of about 94 species, widely distributed in warm regions, mostly arboreal in habitat, rarely on rocks; 13 species in North America; two species in Eastern Pennsylvania and perhaps reaching our region at the east. The two species mentioned may be distinguished as follows:

Key to the Species.

a. Leaves obscurely serrate. 1. *F. ravenelii.*
a. Leaves ciliate-dentate. 2. *F. octoblepharis.*

1. **Fabronia ravenelii** Sullivant.

(*F. caroliniana* Sullivant).

Very small, delicate, loosely cespitose, bright green: stems creeping with more or less erect branches; leaves loose, elongate-lanceolate, subulate-acuminate, concave, costate to the middle, entire or but obscurely serrate; median leaf-cells linear-fusiform, the basal and alar quadrate; inner perichætial leaves ecostate, oblong, short-acuminate: capsule more or less pyriform; the teeth of the peristome brown, 16, approximate in pairs, orange-pellucid, acuminate-deltoid; lid conic, obtuse.

On decayed logs, etc., Southern States. Extends into Pennsylvania from the southeast and may be expected along our southern border.

2. **Fabronia octoblepharis** [Schleicher] Schwaegrichen.

(*F. ciliaris* Bridel; *F. pusilla* Schwaegrichen; *Pterogonium octoblepharis* Schleicher).

Small, delicate, thinly cespitose: stems creeping with erect branches; leaves lance-ovate, filiform-acuminate, thin, green, spreading, sometimes 2-ranked, coarsely and irregularly lacerate-dentate on the border, costate to considerably below the middle, non-plicate, plane-margined, closely imbricate when dry; median leaf-cells thin-walled, linear-rhombic to hexagonal, about 8–10:1, the basal clear across the lower one-fourth or one-fifth of the leaf quadrate or sub-quadrate: seta rather long; capsule oval, neck rather distinct, the urn erect, symmetric, more or less contracted below the mouth when dry and empty; peristome single, with the teeth united in pairs, dark brown, recurved when dry, when old more or less bifid.

On trees throughout the Central States to Minnesota and southwards. Occurs in southeastern Pennsylvania and may reach the southern part of our region.

2. *ANACAMPTODON* Bridel.

Autoicous: mostly densely cespitose, dark green, when old brownish to yellowish, lustrous: stem long-creeping, densely radiculose; the branches short, densely-leaved, erect to ascending; leaves spreading, often secund, ovate to oval, long-acuminate, entire; costa strong, ending above the middle of the leaf; leaf-cells rich in chlorophyll, elongated rhombic-hexagonal, the basal rectangular; inner perichætial leaves elongate, not sheathing, generally acuminate, thinly costate; seta 5–8 mm. long, quite thick, straight, smooth, red to dark castaneous, drying twisted; capsule erect, symmetric, oval, short and thick-necked, drying strongly constricted below the mouth, smooth; annulus broad, delicate but persistent; peristome double, deeply inserted, the teeth strongly hygroscopic, apically united in pairs, broadly lanceolate, pale brown, divisural line almost straight; teeth distantly articulate below, densely finely papillose; basal membrane of inner peristome none, the segments filiform, somewhat shorter than the teeth, non-carinate, brown, almost smooth; lid conic-convex, straight or obliquely rostrate; spores about .008–.010 mm.

A genus of four species; one species each in China, Japan, and Cuba, and the following in Europe and eastern North America.

1. **Anacamptodon splachnoides** [Froelich] Bridel.

(*Campylodontium hypnoides* Schwaegrichen; *Neckera splachnoides* Schwaegrichen).

(Plate XXXIII)

Dark-green or bluish-green, small, delicate, thinly tufted: stems creeping, with erect branches; leaves lance-ovate, up to 1.5 mm. long, acuminate, entire, plano-concave, chlorophyllose, soft, closely imbricated when dry, non-decurrent, non-plicate; costa rather slender, reaching to above the middle of the leaf; median leaf-cells rhombic-hexagonal, about 3–5:1, with a few quadrate and sub-inflated cells at the base; perichætial leaves few: seta about 6–11 mm. long, sinistrorse when dry; capsule erect and symmetric, about 2:1, oval-oblong, thick-necked, constricted below the mouth when dry; peristome double, teeth approximately in pairs and reflexed when dry; 16 in number, lanceolate, pale, articulate, the divisural zigzag; segments filiform, about one-half to two-thirds as long as teeth; no basal membrane; annulus none; exothecial cells castaneous-incrassate, rectangular or irregularly oblong, above smaller and quadrate, those at the rim minute and rounded; lid short-rostrate from a conic-convex base, more or less oblique, one-half to two-thirds as long as the urn; calyptra whitish, covering only the upper part of the urn; spores about .010 mm., minutely papillose, yellowish-green, medium-walled, mature in June.

In moist cavities in decaying wood, knot-holes in trees, in forks of tree-trunks, etc.; Europe, Asia, and from New England to Alabama and Illinois and southwestward to Texas. Collected but seldom in our region, and then only in small quantities.

Indiana	: T. P. James. (Porter's Catalogue).
McKean	: Bradford, different dates, in cavities in decaying wood. D. A. B. (Figured). Issued as No. 148. Grout's North American Musci Pleurocarpi.
Washington	: Linn and Simonton. (Porter's Catalogue).

Family XXX. *LESKEACEAE.*

Autoicous or dioicous: slender to robust, mostly stiff, cespitose, bright or dark green, when old brownish, dull or rarely sub-lustrous: stem without central strand, the primary stems mostly erect, simple, pinnate, or variously branched, rhizoids, often stoloniform with distant minute leaves; secondary stems mostly erect simple, pinnate, or variously branched, both main and secondary stems stoloniferous; paraphyllia mostly present; leaves rarely uniform, usually differentiated into basal and foliate leaves, the latter again into stem-leaves and branch-leaves; basal leaves distant, small, delicate, pale.

smooth, ecostate; foliate leaves pluriseriate, dense, spreading, rarely secund, drying appressed to imbricate, symmetric, apex sometimes one-sided, mostly acuminate, mostly concave, often with two short folds at base, unistratose, mostly papillose; costa mostly simple and strong, rarely short, double, delicate, or forked; cells richly chlorophyllose, mostly parenchymatous, small, often oblong to linear, in the middle of the base, or up to the middle of the leaf; branch-leaves usually shorter and narrower than the stem-leaves; perichætial leaves delicate, hyaline, much elongate, ecostate or weakly costate: seta straight and long; capsule erect and symmetric to cernuous and arcuate, non-plicate; annulus usually present; peristome double, the teeth mostly basally confluent, prominently articulate and trabeculate or dorsally uniformly papillose, with weak ventral plates, whitish to red or brownish, often quite red at the insertion; inner peristome carinate, with basal membrane, segments, and, rarely, with cilia; lid conic or convex-conic and rostrate; calyptra cucullate; spores mostly small.

A large family, mostly in temperate and tropic regions, occurring mainly on trees and rocks; 23 genera; 15 genera in our region.

Key to the Genera.

a. Archegonial clusters borne on the branches: primary stems stoloniform with minute leaves; costa simple; capsule erect, symmetric; segments filiform or rudimentary. b.

a. Archegonial flowers on the stem; stem not stoloniform. c.

b. Very slender; costa not reaching above the middle of the leaf: peristome-segments none. 3. *Haplohymenium.*

b. More or less robust; costa ending in or just below apex; peristome-segments filiform. 4. *Anomodon.*

c. Costa short, simple, forked, double, or none. d.

c. Costa simple (except *Pseudo-Leskiella*), elongate, ending a little below the apex, or excurrent. e.

d. Stem creeping, densely simply pinnate, costa short, simple or forked; teeth non-bordered, non-trabeculate. 1. *Thelia.*

d. Stem ascending to erect, irregularly bushy-branched; costa indistinct or none; teeth bordered, trabeculate. 2. *Myurella.*

e. Leaves of stem and branches alike; stem creeping with ascending or erect, short, blunt branches. f.

e. Stem and branch-leaves unlike; stem 1–3-pinnate, often quite fern-like in general form. h.

f. Teeth without distinct lamellæ; segments filiform. 7. *Leskeella.*

f. Teeth distinctly lamellate; segments narrowly linear or none. g.

g. Teeth with well-developed lamellæ; segments narrowly linear. 6. *Leskea.*

g. Teeth with distinct but low lamellæ; segments none. 5. *Lindbergia.*

h. Cilia 3, smooth; cells of stem-leaves elongate-hexagonal to almost linear; stem and branch-leaves similar. 11. *Elodium.*

h. Cilia 2–4, nodose to appendiculate: cells of stem-leaves rounded-angular to long-hexagonal. i.

i. Operculum merely sharply acute: costa of stem-leaves percurrent to excurrent; leaf-margins indistinctly serrate above. 9. *Haplocladium.*

i. Operculum distinctly rostrate: costa incomplete to excurrent; stem- and branch-leaves dissimilar. j.

j. Margin of stem-leaves entire, base not decurrent; cells uniform, rounded-angular, the median with 2–6 papillæ on each side. 8. *Rauia.*

j. Margin of stem-leaves entire or toothed above, the base somewhat decurrent; cells mostly uniform, rounded- to oval- or oblong-hexagonal, the median ranging from dorsally unipapillose to both sides pluri-papillose. 10. *Thuidium.*

1. *THELIA* Sullivant.

Dioicous: more or less slender, densely cespitose, yellowish to blue-green, dull: stem elongate, creeping, more or less brown-radiculose, densely-leaved, thickly pinnately branched; branches short, julaceous, obtuse, erect to ascending; paraphyllia various; leaves densely imbricate, either dry or moist, more or less decurrent, spoon-like, broadly ovate, abruptly subulate-acuminate, the margins plane, mostly ciliate-serrate to laciniate; costa short, simple or forked; cells rhombic, each dorsally with a high and one- to several-pointed papilla; median basal leaf-cells elongate, the alar in several series almost quadrate; inner perichætial leaves larger, delicate, erect, oblong and subulate-acuminate, with long marginal cilia, costa ending in mid-leaf, areolation elongate, the upper cells unipapillose above: seta 5–15 mm. long, thin, drying twisted, smooth and red; capsule symmetric, erect, oblong to cylindric, golden-brown; annulus none; peristome-teeth basally confluent, narrowly linear-lanceolate, pale, non-bordered, finely papillose, distantly articulate, non-trabeculate; inner peristome pale, papillose, distantly lamellate, non-trabeculate; inner peristome pale, papillose; basal membrane low, segments very short or rudimentary, cilia none; lid conic, short-rostrate; calyptra cucullate, smooth; spores small.

A North American genus of but five species; three species in our region.

Key to the Species.

a. Papillæ on dorsal surface of leaf long, curved, with one point. 1. *T. hirtella.*

a. Papillæ on dorsal leaf-surface lower, each with two or more points. b.

b. Papillæ usually two-pointed; leaves ciliate. 2. *T. asprella.*

b. Papillæ usually 3 or 4 pointed; leaves non-ciliate. 3. *T. lescurii.*

1. **Thelia hirtella** (Hedwig) Sullivant.

(*Pterigynandrum hirtellum* Hedwig; *Hypnum hirtellum* C. Mueller).

(Plate XXXIV)

Light green to glaucous-green, small, forming thin and loosely adherent mats: primary stems creeping, felted with a reddish-brown tomentum, pinnate with numerous short, crowded, julaceous secondary stems and branches; leaves suborbicular, deeply concave, abruptly and narrowly acuminate, decurrent at base, dorsally papillose, the margins plane, spinulose-dentate above, at least in the upper half, fimbriate-ciliate below with usually upturned cilia; costa slender, reaching about to the leaf-middle; median leaf-cells pellucid, rhomboid-elliptic, with long, slender, simple dorsal papillæ; apical leaf-cells linear, the basal larger and looser, the alar quadrate to rectangular, almost smooth, rather incrassate; perichætial leaves numerous, the inner lance-oblong, narrowly acuminate, ciliate-fimbriate in the upper part: seta about 1 cm. long; capsule narrowly oblong-cylindric, about 2.5×0.5 mm., erect, symmetric, thin-walled; peristome-teeth linear, distinctly lamellate, the inner basal membrane truncate and about one-third as high as the teeth, peristome whitish; spores pale yellow, mature in fall, thin-walled, about .012–.015 mm., smooth.

On trunks and roots of trees and on stumps, in woods; from New England and Ontario to Kansas and the Gulf States. Not often collected in our region.

McKean : On trees, near the ground, Gates Hollow, Bradford, April 18, 1897. D. A. B. (Figured).

Westmoreland: T. P. James. (Porter's Catalogue).

2. **Thelia asprella** Sullivant.

(*Leskea asprella* Bryologia Europæa).

(Plate XXXIV)

In most respects quite similar to *T. hirtella*, but more glaucous-green: densely interwoven into mats up to 1.5 mm. thick; leaves bordered nearly all around by somewhat longer cilia, and the papillæ on the dorsal surface of the leaf more or less branched or stellate: peristome-teeth longer with nodose articulations; spores mature in early fall.

In the same habitat as the last species and often mixed with it; ranging from New England to Ontario and Minnesota and south to the Gulf States. Evidently not common in our region.

Erie : In oak woods, Presque Isle, May 8-9, 1906. O. E. J. (Figured).

McKean : D. A. B. (Porter's Catalogue).

3. **Thelia lescurii** Sullivant.

Closely resembling *T. asprella* but with the stouter stems fasciculately branched, whitish or light glaucous-green in color: leaves deltoid-ovate with a shorter acumen than in *T. lescurii,* not so distinctly ciliate-fimbriate; the papillæ usually stellately 3- or 4-lobed; the capsule relatively more slender and longer and on a longer seta; the teeth shorter and only sub-nodosely articulate, the inner membrane longer and with short segments; spores mature in fall.

On flat rocks, ledges, or on dry, sandy soil; from New England to Missouri and the Gulf States. In Eastern Pennsylvania and may occur in our region.

2. *MYURELLA* Bryologia Europæa.

Dioicous: slender, forming cushions or loose tufts, soft (stiff when dry), light to bluish-green, dull to sub-lustrous: in thick tufts the stems are upright, in loose tufts ascending, irregularly bushy-branched with small-leaved stolons, basally bushy-radiculose; branches obtuse, sometimes apically flagelliform; paraphyllia none; leaves 5-seriate, more or less appressed-imbricate, round-ovate, obtuse to abruptly apiculate to acuminate, spoon-shaped, marginally plane to involute, serrate to dentate; costa mostly very short and delicate, simple or forked; sometimes costa none; median leaf-cells small, incrassate, elliptic, some rhomboid, at base short-rectangular to quadrate, smooth or papillose by the thickening of the cell-angles, rarely dorsally mamillate; inner perichætial leaves red-brown, elongate-lanceolate, long-acuminate, plane-margined, serrate, ecostate, with linear cells: seta 10–20 mm. long, thin, drying twisted, red, smooth; capsule erect, somewhat inclined when empty, symmetric, oblong-oval, short-necked, yellow-brown, finally constricted below the mouth; annulus present; peristome-teeth basally confluent, lance-subulate, yellow or pale, bordered by the broader dorsal layer, lamellæ numerous; inner peristome finely papillose, hyaline to pale yellow, basal membrane yellow, carinate, segments lance-subulate, same length as teeth, cilia mostly shorter, filiform; lid brightly colored, conic, acute to obtuse; calyptra fugaceous, small; spores small.

A genus of six species occurring in Europe, Asia, and in North America; one species in our region.

1. **Myurella gracilis** (Weinmann) Lindberg.

(*M. careyana* Sullivant).

Pale glaucous-green, loosely cespitose, interwoven with long radicles below: stems slender, creeping to ascending, stoloniferous, fasciculately branching; the branches julaceous;

leaves loosely imbricate, open-erect, wide-ovate, narrowly long-acuminate, spinulose-dentate all around, very shortly costate or ecostate; leaf-cells large, pellucid, elliptic-rhomboid, dorsally with large papillæ as in *Thelia asprella;* perichætial leaves sheathing, lanceolate, filiform-acuminate, dentate: capsules sub-erect, small, inflated, oval-oblong to obovate-oblong; seta long; peristome normally hypnoid, with articulate, yellowish, transversely-striate teeth, entire segments and cilia two, somewhat shorter than the teeth.

Mainly in crevices and hollows in limestone rocks in hilly or mountainous regions; Europe, Asia, and from Nova Scotia to Minnesota and North Carolina. Rare in our region.

Huntingdon: Alexandria. T. C. Porter. (Porter's Catalogue).

3. *HAPLOHYMENIUM* Dozy and Molkenboer.

Dioicous: slender, stiff, forming mats, dull, dark green to yellowish- or brownish-green: stems filiform, creeping, widely radiculose, here and there in fascicles, more or less pinnately branched, branches spreading, short, obtuse; paraphyllia none; lower leaves smaller, somewhat secund, abruptly lance-subulate and recurved-circinate from a broadly ovate base; costa very short or none; upper leaves spreading to squarrose-spreading, imbricate when dry, from a concave ovate base more or less abruptly lingulate, obtuse to short-acute, non-plicate, margin plane and entire; costa delicate and reaching to mid-leaf, or stronger but not reaching apex; median leaf-cells turgid, thin-walled, rounded-hexagonal, with mostly several papillæ over the lumen, the marginal smaller, transversely broader, in many rows towards the basal margin transversely rectangular or hexagonal, only in middle of base oblong and pellucid: seta 2–4 mm., thin, drying twisted, reddish or yellowish, smooth; capsule erect, oval, smooth, brownish, broadly annulate; peristome-teeth basally confluent, lance-linear, yellowish, distantly articulate, split apart above, the ventral layer broader, hyaline, non-trabeculate, but with papillæ-like irregular processes; inner peristome smooth, the basal membrane very low, with no segments nor cilia; lid conic, obliquely short-rostrate; calyptra inflated-cucullate, furnished with a few long, erect hairs; spores .020–.025 mm., papillose.

About a dozen species, mostly living on tree-trunks, rarely on rocks; one species occurring in North America and reaching our region.

1. **Haplohymenium triste** (Cesati) Kindberg.
(*Leskea tristis* Cesati; *Anomodon tristis* Sullivant).
(Plate XXXIV)

Small, very slender, dull dirty-green, loosely, thinly, and intricately cespitose: stems prostrate, sometimes pendent,

branching with irregularly or pinnately arranged branches; branchlets erect or curved-ascending; leaves about 0.5–0.8 mm. long, appressed when dry, more or less squarrose-spreading when moist, mainly narrow lingulate from an ovate base, concave, sub-clasping, crenulate on the plane margins by the large and protuberant cells, apically acute to short-apiculate or obtuse, the apex of the leaf very often broken off in the dried specimens; costa slender, ending in the middle of the leaf; median leaf-cells oblong-rectangular, about .011–.014 mm. in diameter, thin-walled, pellucid, the upper more or less rounded-hexagonal, the lower marginal transversely oblong-hexagonal, the lower median often radiating from the basal part of the costa in a characteristic manner: capsule unknown: leaf-cells turgid and bearing several large papillæ on each surface.

On bases of trees and on steep, sunny rocks; Europe, Asia, and, in the eastern United States. In the Lesquereux and James Manual the habitat is stated as particularly on the hornbeam. Rare in our region.

Clearfield : T. P. James. (Porter's Catalogue).
McKean : Gates Hollow, Bradford, July 8, 1895. D. A. B. (Figured).

4. *ANOMODON* Hooker and Taylor.

Dioicous: more or less robust, stiff, loosely cespitose, bright to blue-green, dull, later yellowish to brownish, the mats mostly ochraceous inside: stem far-creeping, stoloniform, small-leaved, radiculose, bearing ascending to erect, often basally-stoloniferous secondary stems; all leafy shoots having rather uniform leaves, the branches sometimes flagelliform; foliage-leaves 5-seriate, dense, rarely secund, when dry mostly imbricated, little different when moist, lingulate from a broadly ovate or oblong and little or not at all decurrent base, or the upper part lanceolate to subulate, margins plane and entire; costa strong, smooth, mostly ending below the apex; median leaf-cells rounded-hexagonal, on both sides densely papillose with one- and two-pointed papillæ, rarely unipapillose over the lumen, only the median basal elongate, smooth, rarely rhombic; inner perichætial leaves elongate, sheathing, above similar to the foliage-leaves, or pale, spreading, lance-subulate, with elongate cells: seta more or less elongate, drying twisted, smooth, straight; capsule erect, symmetric, oblong-cylindric, rarely curved, not narrowed below the mouth; peristome-teeth lance-linear, either pale, papillose, distantly articulate, non-trabeculate, or yellowish, striate and weakly trabeculate; inner peristome finely papillose, with basal membrane low, carinate, segments filiform, entire, often attached apically to the columella, cilia rudimentary or, mostly, none; lid conic,

obtuse, acute, or rostrate; calyptra cucullate, smooth; spores small.

About 30 species confined to the Northern Hemisphere; 10 in North America; 5 species in our region.

Key to the Species.

a. Slender and flagelliform branches present: annulus none, teeth striate. 4. *A. attenuatus.*
a. Slender and flagelliform branches none: annulus present. b.
b. Teeth striate: leaves with a hyaline, piliferous-subulate acumination. 5. *A. rostratus.*
b. Teeth papillose, non-striate: leaf-acumination not piliferous-acuminate. c.
c. Leaves with rounded basal auricles, apex apiculate. 1. *A. apiculatus.*
c. Leaves not auricled. d.
d. Leaves not secund, the upper half of leaf oblong-lingulate: teeth nodose. 2. *A. minor.*
d. Leaves more or less secund, lance-lingulate: teeth not nodose. 3. *A. viticulosus.*

1. **Anomodon apiculatus** Bryologia Europæa.

(*Leskea apiculata* W. P. Schimper; *Hypnum rugelii* C. Mueller).

(Plate XXXIV)

Cespitose in tangled mats, glaucous-green, reddish or brownish when old: stems creeping, divided, the secondary stems and branches straight or ascending; leaves 1.5–1.8 mm. long, more or less obscurely two-ranked, abruptly oblong-lingulate from an ovate or oblong-ovate and broader base, the base non-decurrent but with very large and broadly rounded fimbriate-papillose auricles, the apex often apiculate, the upper margin broadly incurved, the leaves when dry crispate; costa pellucid, ending considerably below the apex; leaf-cells opaque, chlorophyllose, minute, rounded, papillose on both faces, the median basal elongate, smooth, the alar somewhat larger, rounded-quadrate; inner perichætial leaves long-sheathing: seta erect, about 5–7 mm. long, dextrorse above, sinistrorse below; capsule erect or somewhat inclined, symmetric, ovate-cylindric, about 2–2.5×0.5 mm., thick-walled, castaneous, longitudinally many-plicate when dry; annulus none; lid conic-acuminate, small; peristome double, the teeth lance-linear, nodose-articulate, faintly papillose, the dorsal lamellæ and divisural usually very faint or invisible, the segments rudimentary, or very short, from a low basal membrane; spores mature in autumn, medium-walled, brownish, papillose, about .009–.012 mm.

On shaded rocks and bases of trees or on decayed logs, in woods, mainly in mountainous districts; Europe, Asia, and from New England to Ontario and Georgia. Rare in our region.

McKean : Bennett Brook, Bradford, November 7, 1897, and Limestone Creek, Bradford, October to December, 1896. D. A. B. (Figured). The latter mixed with Grout's No. 134, North American Musci Pleurocarpi.

2. **Anomodon minor** (Hedwig) Fuernrohr.

(*Neckera viticulosa* var. *minor* Hedwig; *A. obtusifolius* Bryologia Europæa).

(Plate XXXIV)

Loosely widely cespitose, glaucous-green, brownish when old: primary stems creeping, flagellate, robust, with numerous, more or less erect, secondary stems and branches usually up to height of 2–4 cm.; leaves somewhat complanate, broadly lingulate-obtuse from a broadly ovate base, thick, opaquely chlorophyllose, entire, very densely papillose on both sides; costa pellucid, rather strong, vanishing below apex; leaf-cells minute, about .009–.012 mm., rounded-hexagonal, the median basal elongate and non-papillose, the alar scarcely different from the upper; perichætial leaves sheathing: seta erect, about 1 cm. high, sinistrorse; capsule erect, castaneous, about 2 mm. long, symmetric, oblong-cylindric, about 3:1, the mouth small; lid conic-acuminate, about two-fifths as long as urn; annulus present, large; peristome-teeth narrowly lance-linear, hyaline, faintly papillose, about 8–10-nodose-articulate, the divisural and dorsal lamellæ very faint or not visible, the segments very short or rudimentary, or none, from a very low basal membrane; exothecial cells rather thin-walled, irregularly quadrate to oblong-rectangular; spores maturing in late fall or in winter, medium to thin-walled, brownish, papillose, .009–.012 mm. in diameter.

On rocks and trees, in woods, usually at the base of trees; Asia and from New Brunswick to Virginia and westward to South Dakota. Probably rather common in our region.

Allegheny : Near Montrose, September 21, 1905. O. E. J.
Cambria : T. P. James. (Porter's Catalogue).
Clearfield : Phillipsburg. T. P. James. (Porter's Catalogue).
McKean : Lewiston Creek, November 21, 1897. D. A. B. (Figured).
Washington : Linn and Simonton. (Porter's Catalogue).

3. **Anomodon viticulosus** [Linnæus] Hooker and Taylor.

Large, widely tufted, dark green above, yellowish within: stems creeping, long, sending up secondary stems and branches, the secondary stems sometimes becoming more or less geniculate by repeated innovations: leaves more or less

crisped when dry, sub-falcate, secund, lance-ovate, frequently serrulate at the apex, apex bluntly acute; costa strong, pellucid, ending a little below the apex; median, upper, and lower marginal leaf-cells opaque, minute, rounded-quadrate, the median basal somewhat elongated, cells minutely papillose; perichætial leaves long, linear-acuminate from an ovate base: seta twisted when dry, erect; capsule oblong-cylindric, symmetric or slightly curved, about 3:1; lid narrowly conic; peristome-teeth lance-linear, more or less irregular, yellowish, the inner peristome consisting of a very low basal membrane and very short, irregular segments; annulus double; spores mature in winter or early spring.

Mostly on shaded rocks, sometimes on trees; Europe, Algeria, Asia, and in lower Canada and the northern United States. Occurs in Pennsylvania at least as far west as Franklin County, and is to be looked for in our region also.

4. **Anomodon attenuatus** [Schreber] Huebener.

(*Leskea attenuata* Hedwig; *Hypnum attenuatum* Schreber).

(Plate XXXIV)

Slender, loosely and widely tufted, with the secondary stems fasciculately branched and with numerous slender flagelliform branches; leaves spreading to secund, concave, usually more or less distinctly homomallous when dry, about 0.8–1.2 mm. long, broadly lanceolate from an ovate base which is plainly narrowed to the insertion, the insertion somewhat excavate and decurrent, the apex acute and minutely apiculate and often with a very few teeth near the apiculation, the leaf-margins plane below, and usually minutely crenulate by reason of the projecting papillæ; costa strong, ending a little below the apex; areolation densely papillose on both sides, irregularly hexagonal to quadrate, opaque, rather thin-walled, a few of the median basal elongate-rectangular to oblong, pellucid; perichætial leaves lance-acuminate from an ovate base: seta about 2 cm. long, twisted; capsule long, cylindric, straight or slightly curved, lustrous, castaneous; lid long-rostrate; teeth of peristome narrowly lanceolate, the segments filiform, irregular, fragile, nearly as long as the teeth; annulus narrow; spores mature in fall.

On bases of trees, stumps, and rocks, in woods; Europe, Asia, and from Newfoundland to British Columbia and south to Florida and Cuba. Common in our region but usually sterile.

Allegheny : Along Brush Creek, near Douthett, April 26, 1908, and June 5, 1909. O. E. J.; Wildwood Road hollow, November 19, 1908. O. E. J. and G. K. J. (Figured).

Fayette : Meadow Run Valley, four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
Huntingdon : Bark of oak tree, Pennsylvania Furnace, July 13, 1909. O. E. J.
McKean : Bolivar Run, Bradford, September 16, 1897. D. A. B.
Washington : Linn and Simonton. (Porter's Catalogue).
Westmoreland : Shades, near Blackburn, March 25, 1910, forming an "apron" on base of white oak tree. O. E. J. and G. K. J.

5. **Anomodon rostratus** (Hedwig) Schimper.

(*Leskea rostrata* Hedwig).

(Plate XXXIV)

Densely cespitose, tufts bright green above, yellowish inside: primary stems creeping, fasciculately branched with slender julaceous secondary stems and branches; leaves densely imbricate, ovate and concave at base, narrowly lanceolate above with a long and hyaline piliferous acumination, more or less indistinctly two-ranked, the margin crenulate-papillose, often recurved towards the middle; leaf-cells minute, chlorophyllose, opaque, rounded-quadrate to oblong-hexagonal, pluri-papillose on both faces, the median marginal rounded-quadrate, about .008–.010 mm., the median interior about as wide but more oblong, about 2:1, the median basal longer, hyaline and non-papillose or but slightly so, the apical long and linear, smooth; costa strong and ending a little below the apex; perichætial leaves long, pale, ecostate, the inner with a filiform and often reflexed point about as long as the main portion of the leaf: seta short, about 7–10 mm. long, erect, sinistrorse, richly castaneous; capsule about 2 mm. long, oval-oblong, about 2.5:1, erect, symmetric castaneous; lid conic, obliquely rostrate, about one-half to three-fifths as long as the urn; teeth small, lance-linear, the divisural and dorsal lamellæ indistinct, the teeth with about 15 to 18 nodose articulations, pale, papillose; segments about as long as the teeth, linear, rising from a basal membrane about one-third as high as the teeth, the cilia solitary and rudimentary or none; exothecial cells medium-walled, oblong-rectangular to oblong-hexagonal, becoming quadrate above, about two rows at the rim much smaller and heavily castaneous-incrassate; spores mature in fall, thin-walled, nearly smooth, slightly brownish, about .010 mm. in diameter.

On rocks or more usually on the bases of trees; Europe, Asia, and from Canada to the Gulf States. Very common in our region, especially on the base of white oak trees.

Allegheny : Moon Township, April, 1902. J. A. S.; Guyasuta Hollow, October 25, 1908, swampy woods near Douthett, December 29, 1908. O. E. J.; Wildwood Road Hollow, November 19, 1909. O. E. J. and G. K. J.

Beaver : Beaver Falls, May 4, 1907. O. E. J.

Butler : Swampy woods near Crider's Corners, December 29, 1908. O. E. J.

Center : On log, Bald Eagle Ridge, Matternville, September 20, 1909. O. E. J.

Crawford : Linesville, August 19, 1904; May 12, 1908, and August 3, 1909. O. E. J.

Fayette : Ohio Pyle, four miles up valley of Meadow Run, May 30-31, 1908, and September 1-3, 1906. (Figured). Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.

Huntingdon : Pennsylvania Furnace and on Tussey's Mt., near Baileyville, July 13, 1909. O. E. J.

McKean : Bradford. D. A. B. Porter's Catalogue).

Washington : Linn and Simonton. (Porter's Catalogue); three miles southwest of Library, April 29, 1906, and Hanlin, May 21, 1908. O. E. J.

5. *LINDBERGIA* Kindberg).

(*Fabroleskea* Grout).

Autoicous: rather softly and loosely cespitose, bright to brownish-green, dull: stem elongate, creeping, radiculose, densely-leaved, branched with elongate mostly irregularly pinnate branches; branchlets short or unequal in length, obtuse; dry leaves imbricate, when moist spreading to almost squarrose-spreading, somewhat concave, more or less decurrent, ovate to lance-ovate, abruptly subulate-acuminate, nonplicate, margins entire or rarely indistinctly apically serrulate; costa strong, incomplete; median leaf-cells lax, round-oval or rhombic hexagonal, smooth, or unipapillose, the marginal smaller and quadrate or transversely broader, the basal marginal in many rows quadrate to transversely broader; inner perichætial larger, thin, erect, from a sheathing base subulate-acuminate, entire or serrulate; costa shorter: seta 5–10 mm. long, straight, thin, red, smooth; capsule erect, symmetric, oval-oblong, rarely slightly curved, brown, small-mouthed and short-necked; annulus present or none; peristome deeply inserted, teeth lanceolate, obtuse, basally confluent, pale to yellow, non-striate, more or less papillose, divisural zigzag, low-trabeculate; inner peristome papillose with a very low

basal membrane, no segments, no cilia; lid conic-obtuse; calyptra cucullate; spores .025–.030 mm.

As here limited the genus consists of 6 species, occurring on tree-trunks in the Northern Hemisphere; two species in North America; one species in our region.

1. **Lindbergia austini** (Sullivant) Brotherus.

(*Fabroleskea austini* Grout; *Leskea austini* Sullivant).

Medium size, intricately matted; stems irregularly divided, the branches usually quite unequal; leaves spreading to more or less squarrose when moistened, imbricate when dry, ovate, long and slenderly acuminate, strongly papillose, entire; costa ending above the middle; leaf-cells unipapillate, elliptic-rhomboid above, the basal marginal thick, rounded-quadrate; perichætial leaves longer, lance-acuminate: seta short, erect; capsule erect, oval-cylindric with a small mouth; teeth broadly lanceolate, deeply inserted, opaque, papillose on both surfaces, the inner peristome consisting merely of a low basal membrane scarcely exceeding the rim of the urn; annulus none; lid short-conic; spores mature in summer.

On tree-trunks and on rocks or stone-walls; northeastern United States from New Jersey to Minnesota and Kansas. In Porter's Catalogue the habitat is given as *Juniperus virginianus*. Not yet collected in our region.

6. *LESKEA* Hedwig.

Autoicous: rather slender, usually weak, loosely cespitose, dull, dark to sooty-green: stems creeping, sparsely radiculose, rather thickly-leaved, more or less pinnately branched, with short, erect or ascending branches; leaves when dry imbricate, when moist erect-spreading to spreading, sometimes subsecund, from a somewhat decurrent, cordate-ovate base narrowed to an acute or obtuse apex, sometimes apiculate, shortly two-plicate, revolute on one or both lower margins, rarely indistinctly serrate at apex; costa strong, incomplete; median leaf-cells either thin-walled, rounded-hexagonal, one- to several-papillose, at the base almost quadrate, in the middle rhomboidal, or more or less thickened, with oval to oblong acumen; branch-leaves smaller; inner perichætial leaves pale, sheathing, abruptly to slenderly acuminate, entire or serrulate, at the apex, delicately and incompletely costate: seta long, thin, red, smooth; capsule erect, oblong-cylindric, sometimes slightly curved and weakly inclined, yellowish, finally light brown and plicate; annulus revoluble; teeth drying strongly incurved, linear, acuminate, entirely separate, non-bordered, pale yellow, at the base transversely dorsally striate, thickly trabeculate, papillose above; inner peristome papillose, basal membrane

low, segments linear, carinate, as long or shorter than the teeth, cilia rudimentary; lid acute-conic; calyptra cucullate, glabrous; spores small.

A widely distributed genus of about 20 species; 7 species in North America; 3 in our region.

Key to the Species.

a. Leaves more or less secund, lance-ovate: capsule sometimes slightly curved. 1. *L. polycarpa.*

a. Leaves not secund, ovate, acute to obtuse; capsule erect, straight. b.

b. Leaves two-plicate, symmetric, the margin often revolute. 2. *L. gracilescens.*

b. Leaves non-plicate, unsymmetric, plane-margined. 3. *L. obscura.*

1. **Leskea polycarpa** Ehrhart, Hedwig.

(*L. polycarpa* Ehrhart; *Hypnum medium* Dickson).

Slender, thinly tufted: stems prostrate, pinnately to bi-pinnately branched, 2–4 cm. long, with short curved or erect branches, intricately matted into close but thin patches; leaves erect-spreading to secund, loosely appressed-imbricate when dry, about 0.4×1.0 mm., lanceolate and gradually acute from a slightly decurrent, sub-cordate, more or less ovate base, entire, usually two-plicate, acute to acuminate; costa ending a little below the apex; median leaf-cells thin-walled, pellucid, more or less dorsally papillose, hexagonal, about .007–.008 mm. wide, with one or two papillæ on each surface; branch-leaves smaller and more obtusely pointed: seta about 1 cm. long, reddish; capsule cylindric, narrow, basally tapering, straight or almost so, reddish-brown, constricted below the mouth when dry; lid elongate-conic, acute; peristome-teeth long, whitish, narrowly linear, connivent when dry, the segments about as long, from a low basal membrane narrowly linear, scarcely carinately split; cilia rudimentary or none; spores mature in early summer.

On roots, bases of trees, stones, or decaying wood in wet situations; Asia, and from Newfoundland to British Columbia and southward. Not yet found in our region.

2. **Leskea gracilescens** Hedwig.

(*L. obscura* Lesquereux and James, p.p.; *Hypnum gracilescens* Beauvois).

Intricately cespitose in thin mats: stems prostrate, pinnately branched with numerous simple, erect, somewhat julaceous branchlets; paraphyllia usually few, lanceolate; stem-leaves erect-spreading when moist, appressed-imbricate when dry, about 0.4–0.5×0.7–0.9 mm., ovate, acute or somewhat acuminate, entire, margins more or less revolute, sometimes more quickly tapering to a blunt point, somewhat bi-plicate; costa

sub-percurrent; branch-leaves hardly different but scarcely plicate; median leaf-cells usually uni-papillate on dorsal surface, smooth on ventral, quadrate-hexagonal, about .008–.010 mm., the apical more rounded, the basal somewhat quadrate; capsule erect, basally tapering, oblong-cylindric; peristome-teeth whitish, lance-linear, lamellate, about 0.4 mm. long, the linear segments shorter, carinate, sometimes more or less rudimentary, cilia none; lid conic, acute to obtuse; spores mature in summer.

On the bases of trees, roots, and on rotten logs, etc.; from eastern lower Canada to the Gulf States and westward to the Rocky Mountains. Only once reported in our region.

Washington : Linn and Simonton. (Porter's Catalogue).

3. **Leskea obscura** Hedwig.

(*L. nervosa* Sullivant; *L. microcarpa* Schimper).

(Plate XXXV)

Small, loosely and intricately cespitose, dark green: stems prostrate, rather irregularly divided, sparingly branched; leaves incurved-appressed when dry, spreading when moist, about 0.8–1.2 mm. long, from an ovate base narrowed above to a rather blunt apex, concave, recurved on the margin, entire or serrulate; costa ending a little below the apex; median leaf-cells quadrate-hexagonal, about .008–.010 mm. wide, with several small papillae on the lower surface, on the upper surface less papillose or almost smooth, apical and basal cells somewhat wider and shorter, the alar oblong-quadrate; branch-leaves similar; perichætial leaves long-sheathing, rather laxly-celled, costate: seta about 1.5–2 cm. long; capsule erect, straight, short-cylindric, sometimes slightly curved, more or less wrinkled and contracted below the mouth when dry; lid conic, rather obtuse; peristome-teeth yellowish, papillose, the segments linear, slender, carinately cleft between the articulations, shorter than the teeth, arising from a basal membrane about one-fifth the length of the teeth; spores mature in early summer.

On stones, roots of trees, logs, etc., often where sometimes overflowed; Japan, and from New Brunswick to Ontario and southwards through the eastern and central part of the United States. Probably fairly common in our region.

Allegheny : On bark of white oak at three feet from ground, Fern Hollow, Pittsburgh, March 8, 1908, and at base of trees in swampy woods near Douthett, December 29, 1908. O. E. J. (Figured).

Blair : Tyrone. T. P. James. (Porter's Catalogue).

McKean : Tuna Creek, Bradford, December 21, 1895. D. A. B.

Washington : Linn and Simonton. (Porter's Catalogue).

7. *LESKEELLA* (Limpricht) Loeske.

Dioicous: slender, in flattened, wide-spreading mats, dark green to brownish, dull; stem widely creeping, fasciculately yellowish-red-radiculose, densely-leaved, numerously-branched, with erect and short branches; leaves drying imbricate, when moist erect-spreading to secund, more or less abruptly long-acuminate from a decurrent, doubly-plicate, cordate base, margins narrowly revolute below but plane in the acumen, entire; costa strong, yellow-brown, ending in the acumen; cells rounded-hexagonal, in leaf-middle oval and oblong, in middle of base rectangular, the alar quadrate; branch-leaves smaller with plane margins and delicate and shorter costa; perichætial leaves pale, from the erect and half-sheathing base abruptly long-acuminate, delicately costate to the acumen: seta elongate, stiff, dark chestnut-color, smooth; capsule erect, symmetric, cylindric or oblong, rarely weakly curved, finally rust-colored to brown; annulus rather persistent, deciduous in sections; peristome-teeth erect when dry, confluent at base, subulate, bordered, yellowish, cross- and obliquely-striate, smooth or papillose above, not distinctly trabeculate; inner peristome yellow, finely papillose, basal membrane moderately prominent, segments irregular, in nodose projections, filiform, etc., sometimes carinate, cilia mostly none; lid convex, obliquely thick-rostrate; calyptra glabrous, cucullate and reaching to base of capsule; spores small.

A small genus of 5 species; only the following in North America:

1. **Leskeella nervosa** [Bridel] Loeske.

(*Leskea nervosa* Myrin; *Lescuraea rigidula* Kindberg; *Hypnum nervosum* C. Mueller).

(Plate XXXV)

Slender, in thin and appressed tufts, dark green to brownish, the older parts almost black: stems creeping, up to 5 or 6 cm. long, pinnately divided and again branched into numerous, crowded, short and erect or longer and creeping branches, often with numerous gemmiform branches towards the apex; stem-leaves close, broadly ovate, sub-cordate, open-spreading when moist, imbricate when dry, slightly decurrent, about 0.4–0.5×1–1.2 mm., suddenly long-acuminate, the acumen recurved, the margins plane, sub-sinuate, the blade concave and deeply plicate; costa almost percurrent, slender; branch-leaves considerably narrower, lanceolate, more rigidly erect-spreading, smaller, up to about 0.6–0.7 mm. long; leaf-cells oblong to

oval-hexagonal, ranging from 1 to 3:1, the alar quadrate to transversely oval-hexagonal in about 4–6 rows extending well up the margins and becoming rounded; cells smooth to lightly papillose, incrassate; inner perichætial leaves long-sheathing, long-acuminate: seta short; capsule erect, sub-cylindric, symmetric, small, castaneous; lid narrowly conic to short-rostrate; peristome short, the teeth whitish, lance-linear, the segments shorter, irregular, subulate, basal membrane and cilia none; annulus narrow; spores mature in summer.

On bases of trees, especially maples, in our region: Europe, and in the northeastern United States. Not common in our region.

Fayette : Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.

McKean : Bennett Brook, Bradford, July 12, 1896. (Figured), and Bolivar Run, September 11, 1896. D. A. B.

8. *RAUIA* Austin.

Autoicous: quite slender, dull, bluish-green to brownish-green: stems thickly-leaved, simple or divided, more or less regularly pinnately branched; branchlets short, ascending, julaceous, obtuse; leaves dimorphic, drying imbricate, when moist erect-spreading; stem-leaves plicate, triangular to cordate-ovate, tapering to a lanceolate or lance-subulate acumination, the margins entire; costa strong, incomplete; median leaf-cells rounded-angular, with low and usually numerous papillæ on both sides; branch-leaves lance-ovate, short-pointed, the costa dorsally somewhat rough; inner perichætial leaves appressed, pale, lance-oblong, slenderly acuminate, entire, incompletely costate, and with elongate, smooth cells: seta slender, 10–15 mm. long, reddish, smooth; capsule from nearly upright to horizontal, oblong-cylindric, mostly weakly curved, light brown, drying more or less constricted below the mouth; annulus revoluble; peristome-teeth lance-subulate, bordered, transversely striate, numerously trabeculate; inner peristome yellow, finely papillose, basal membrane prominent, carinate, the segments about as long as the teeth, carinately split, the cilia 2 or 3, more or less complete, nodose; lid conic, short-rostrate; calyptra cucullate; spores .009–.011 mm.

A genus of about 13 or 14 species, widely distributed in both hemispheres; 5 species in North America; 1 species in our region.

1. **Rauia scita** (Beauvois) Austin.

(*Thuidium scitum* Austin; *Hypnum scitum* Beauvois).

(Plate XXXV)

In appressed, green or yellowish-brown tufts, medium-sized: stem prostrate, castaneous, 2–3-times divided; densely

pinnately branched; branchlets short and slender, usually about 2–3 mm. long, smooth, paraphyllia present; stem-leaves broadly cordate-deltoid, acuminate, about 0.5–0.6 mm. long, margins plane, finely papillose-denticulate; branch-leaves ovate-cordate, smaller, shorter acuminate, both kinds of leaves concave, erect-spreading; costa pellucid, broad, about three-fifths to four-fifths as long as the leaf; median leaf-cells rounded-hexagonal, minute, with 2–5 small bead-like papillæ on each surface, incrassate, rather obscure, the basal median oblong, paraphyllia numerous, linear to ovate, more or less branched, occurring on both stem and branches; inner perichætial leaves elongate-lanceolate, filiform-acuminate, somewhat longitudinally plicate: capsule sub-erect, about 1.3–1.5 mm. long, rather thin-walled, when old and empty more or less wrinkled, urn cylindric, straight or slightly curved, more or less twisted when old, the seta about 1.5 cm. long; lid conic-rostrate, curved upward; annulus large; exothecial cells rather thin-walled, mainly quadrate to rectangular; peristome-teeth lance-subulate, shallowly inserted, castaneous and transversely striolate below, hyaline and papillose above, lamellate and trabeculate; segments nearly as long as teeth, carinately partially split, the basal membrane about two-fifths as high, the cilia usually three, nodose; spores medium-walled, castaneous-pellucid, papillose, about .010–.013 mm., mature in fall and winter; autoicious.

On the bases of trees and on stones in woods; from Ontario to Missouri, eastward to the Atlantic Ocean and southward to North Carolina. Rare in our region.

McKean : On base of trees, Rutherford, August 4, 1897, Bradford, October, 1897; Gates Hollow, July 28, 1895, and Limestone Creek, Bradford, October to December, 1896. D. A. B. (Figured). The last named specimen issued with Grout's No. 134, in part, North American Musci Pleurocarpi.

9. *HAPLOCLADIUM* (C. Mueller) C. Mueller.

Autoicous: slender, forming mats, yellowish-green to brownish-yellow, dull: stems creeping, elongate, with brownish rhizoids, variously pinnate with branches mostly ascending, julaceous, short, obtuse and simple, or somewhat longer, acute and pinnate with scattering short branchlets; leaves more or less uniform, drying appressed, sometimes weakly secund, when moist erect-spreading; stem-leaves more or less doubly plicate, from a more or less broadly ovate base, lanceolate to lance-subulate, the margin revolute at base, the upper margin indistinctly serrulate to entire; costa strong, sometimes percurrent, sometimes excurrent, mostly smooth; cells more or

less pellucid, oval to oblong-hexagonal, with one papilla over the lumen, the alar quadrate; branch-leaves narrower at the base, shorter-pointed, plane-margined, more or less distinctly serrate; costa shorter, cells mostly opaque; inner perichætial leaves erect, pale, plicate, from a lanceolate or linear base long-acuminate, incompletely costate: seta 1.5–2.5 cm. long, red-castaneous, smooth; capsule inclined, oblong-cylindric, drying more or less horizontal and arcuate, when old and empty contracted below the mouth; annulus present; peristome-teeth lance-subulate, yellow, bordered, transversely-striate, dorsally lamellate; inner peristome yellowish, the basal membrane wide and carinate, the segments lance-subulate, of same length as teeth, carinate, entire or narrowly split, cilia complete, 2 or 3, slender, nodose or appendiculate; lid convex-conic; acute; calyptra cucullate; spores .008–.012 mm.

A genus of nearly 50 species, mostly occurring in eastern Asia and in South America; only the following in our region:

Key to the Species.

a. Stem-leaves rounded-ovate, short-acuminate.
1. *H. virginianum.*

a. Stem-leaves ovate, more or less long-acuminate.
2. *H. microphyllum.*

1. **Haplocladium virginianum** (Bridel) Brotherus.

(*Thuidium virginianum* Lindberg; *T. gracile* var. *lancastriense* Cardot; *Hypnum gracile* var. *lancastriense* Sullivant and Lesquereux).

(Plate XXXV)

Small to medium-sized, appressed-cespitose, dark to dirty green: stems diffusely divided, the branches short and erect or ascending; leaves of the stems rounded-ovate, concave, narrowed to the base but scarcely decurrent, about 0.6–0.8 mm. long, abruptly acuminate, costate into the acumen, serrulate above, erose-dentate below, appressed when dry, loose when moist; median leaf-cells quadrate-hexagonal, uni-papillate, rather incrassate, the lower marginal more or less transversely oblong-quadrate or hexagonal; branch-leaves about 0.4–0.6 mm. long, broadly and shortly acuminate with a serrulate margin above; perichætial leaves long, pale, up to 2.5 mm. long: seta slender, about 2–2.5 cm. long, rather richly castaneous, dextrorse; capsule oblong-cylindric, castaneous, curved, more or less horizontal, often when old more or less pendent by the curving of the upper part of the seta, the urn about 2.5:1, about 2 mm. long, constricted below the mouth when dry and empty; lid obtusely short-beaked, about one-third as long as the urn; peristome normally hypnoid, yellowish, the 16 teeth lance-linear, dorsally cross-striate, with zigzag divisural line, distinct dorsal lamellæ, and about 35–40 closely placed tra-

beculæ; segments about as long as teeth, carinate; cilia (1–) 2–3, nodose-articulate, the basal membrane about two-fifths the height of the peristome; exothecial cells incrassate, quadrate to oblong-hexagonal, about three series in the rim much smaller and rounded; spores incrassate, yellowish, faintly papillose, about .011–.014 mm., mature in spring.

On the ground or on roots of trees in rather open woods; from New England to Minnesota and Mexico, also in Europe. Quite common in our region.

Blair	: Bald Eagle Valley. T. C. Porter. (Porter's Catalogue).
Cambria	: Cresson. T. P. James. (Porter's Catalogue).
Center	: Tussey's Mt., above Shingletown, July 15, 1909. O. E. J.
Fayette	: On woods-humus, Meadow Run Valley, four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
Huntingdon	: Warrior's Ridge, above Huntingdon, July 20, 1908. O. E. J. (Figured).
Westmoreland	: Two miles south of Trafford, August 21, 1910. O. E. J.; Laurel Hill Mt., Mellon's estate, on soil with *Diphyscium foliosum*, September 8-11, 1907. O. E. J.

2. **Haplocladium microphyllum** (Swartz) Brotherus. (*Hypnum gracile* Bruch and Schimper; *Thuidium microphyllum* Best).

(Plate XXXV)

Medium size, pale green to yellowish, appressed-matted: stems diffusely divided, densely pinnately branched; stem-leaves broadly ovate to lance-ovate, up to 1.2 mm. long, concave, long and narrowly acuminate, the margins entire or sinuately denticulate; costa almost percurrent; leaf-cells quadrate-hexagonal, somewhat incrassate, the apical and a very few of the basal elongate, all strongly uni-papillate; branch-leaves narrower and smaller, up to 1 mm. long; paraphyllia numerous and branched on the stem but simple and few or none on the smaller branches; inner perichætial leaves high-sheathing, long-acuminate, costate, up to 2.5 mm. long: seta up to 2 or 2.5 cm. long, castaneous, twisted, somewhat arcuate above; capsule turgid-oblong, about 2–2.5:1, about 2 cm. long, dorsally somewhat turgid, when mature somewhat inclined or pendent by the curving of the upper part of the seta; lid short-conic, mamillate; peristome normally hypnoid, the teeth yellowish, densely trabeculate, dorsally with rather indistinct lamellæ and divisural, finely cross-striate, narrowly hyaline-margined; segments carinate, about as long as teeth; cilia 2 to

3, a little shorter than the teeth, strongly nodose to shortly appendiculate, the basal membrane about one-third as high as teeth; annulus simple; spores mature in summer, somewhat incrassate, pale brownish-pellucid, very slightly roughened.

On earth, rotten wood, etc., often on bases of trees; Europe, Asia, and from southern Canada to the West Indies. Rare in our region.

McKean : On hillside at mouth of Langmade Hollow, Bradford, November, 1895, (Figured) and Limestone Creek, N. Y., near the Pennsylvania State line north of Bradford, October 16, 1896. D. A. B.

10. *THUIDIUM* Bryologia Europæa.

Autoicous or dioicous: slender to robust, mostly stiff, dull, forming greenish to yellowish or brownish mats or cushions: stem with a few-celled central strand, spreading to ascending or rarely erect, radiculose here and there in fascicles, not much divided, once to thrice pinnately branched, flattened like the frond of a fern; leaves dimorphic, when dry incurved or appressed, when moist erect-spreading or open-erect but never secund; stem-leaves plicate, from a narrowed and decurrent base, mostly with revolute margin, entire or apically toothed; costa strong, mostly incomplete, rarely excurrent, sometimes dorsally rough, leaf-cells rather uniform, rounded to oval- or oblong-hexagonal, both sides numerously papillose or unipapillose dorsally or on both sides; branch-leaves of first order often similar to stem-leaves, those of the second or third order smaller, mostly lance-ovate, with the costa weaker and shorter; inner perichætial leaves pale, appressed, mostly lanceolate and plicate, often with a prolonged and filiform apex, sometimes with ciliate margins, costa incomplete, cells elongate, smooth: seta elongate, castaneous or red, smooth or rough; capsule inclined to horizontal, oval-oblong to cylindric, more or less arcuate, brown to yellow, drying constricted below the mouth; annulus sometimes persistent; peristome-teeth basally confluent, lance-subulate, bordered, cross-striate, numerously trabeculate; inner peristome yellow to orange, smooth or finely papillose, with prominent carinate basal membrane, segments as long as teeth, carinately split at least in part; cilia 2–4, nodose to appendiculate, or sometimes rudimentary, or none; lid convex-conic, obliquely rostrate; calyptra cucullate, mostly smooth; spores .007–.010 mm. or .012–.016 mm.

A widely distributed family of about 175 species, on tree-trunks, rocks, or earth; about 25 species in North America; at least 3, probably more, in our region.

Key to the Species.

a. Delicate, small, not over 5 cm.; 1–2-pinnate. b.

a. Larger, up to 10 cm.; 1–3-pinnate. c.

b. Branchlets papillate; leaf-cells about .006 mm.: seta 1–2 cm. long. (*T. pygmaeum* (Sull.) Bryol. Eur.).

b. Branchlets smooth; cells about .009 mm.: seta 2-4 cm. long. 1. *T. minutulum.*

c. Stems simply pinnate; plants ascending in tufts. (*T. abietinum* [L.] Bryol. Eur.).

c. Stems 2–3-pinnate, forming flat mats. d.

d. Leaf-margin revolute; costa not filling entire apex of leaf. e.

d. Leaf-margin plane; costa of stem-leaves filling the entire apex; perichætial leaves not ciliate. 3. *T. recognitum.*

e. Stem-leaves lance-acuminate: perichætial leaves ciliate. 2. *T. delicatulum.*

e. Stem-leaves long-lance-subulate; perichætial leaves not ciliate. (*T. philiberti* Limpricht).

1. **Thuidium minutulum** [Hedwig] Bryologia Europæa.

(*Hypnum minutulum* Hedwig).

(Plate XXXV)

Small, slender, simply pinnate; stems irregularly divided, not over 3 or 4 cm. long, both stems and branches smooth, bearing rather few linear-oblong simple paraphyllia only about 2 to 5 cells high, notched at apex; stem-leaves distant, deltoid, acuminate or apiculate, somewhat revolute on the borders, rather opaque, about 0.6–0.8 mm. long; costa strong, ending near the apex; median leaf-cells irregularly polygonal to quadrate-hexagonal, the marginal somewhat larger and sometimes transversely elongate, all leaf-cells incrassate, pluripapillose, the apical cell with 2 to 5 marginal papillæ; branch-leaves ovate-acuminate, about 0.2–0.3 mm. long, concave and with a shorter costa; perichætial leaves erect, slenderly lance-acuminate, the acumen more or less reflexed: seta about 2–2.5 cm. long, slender, dark yellow or brown and sinistrorse when old; capsule yellowish, oval-oblong, cernuous to horizontal, the urn about 2 mm. long, when dry somewhat constricted below the rim; lid obliquely subulate-rostrate and about 1 mm. long; peristome castaneous, the teeth slender, densely trabeculate, the dorsal lamellæ cross-striate and projecting to form a narrow margin, the divisural distinct; segments as long as the teeth, split carinately, arising from a basal membrane about one-third as high, cilia usually 2, articulate, nearly as long; spores about .010–.012 mm., pale brown, medium-walled, slightly roughened, mature in fall.

On rotten logs and stumps and at the base of trees in woods; Europe, and from New Brunswick to Minnesota and south to Florida and Mexico. Common in our region.

Allegheny : Keown, November 14, 1909, and Darlington Hollow, Sharpsburg, November 9, 1908. O. E. J.; Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J.

Blair : Burgoon's Gap. A. P. Garber. (Porter's Catalogue).

Fayette : Meadow Run Valley, four miles south of Ohio Pyle, on stump, September 1-3, 1906. O. E. J. and G. K. J. (Figured).

Huntingdon : T. C. Porter. (Porter's Catalogue).

McKean : On decaying logs, Bolivar Run, Bradford, August 8, 1896, and Marilla Brook, October 22, 1896, also near Bradford. D. A. B.

2. **Thuidium delicatulum** [Linnæus] Mitten.

(*Hypnum delicatulum* Linnæus; *H. tamariscinum* Sullivant and Lesquereux).

(Plate XXXVI)

The "Common Fern Moss."—Bright green above, darker below, large, forming rather large and intricately woven mats, when dry rather stiff and harsh: stems elongate, procumbent or arched and alternately rooting, often reaching a length of 10 or 12 cm.; the branching is twice or thrice pinnate, very regular and fern-like; stem-leaves triangular-ovate, somewhat cordate, gradually acuminate, about 1 mm. long, erect-spreading, appressed when dry, somewhat serrate and marginally more or less recurved; leaf-cells unipapillate on both sides, rather incrassate, the median quadrate-oblong to rhombic-oval or rounded-quadrate, about .007 to .008 mm. across; costa strong and ending in the acumen; branch-leaves much smaller, broadly ovate, acuminate, the apical cells with 2 to 4 papillæ; perichætial bracts ciliate on the margins: seta about 2 to 3 cm. long, rather stiff, richly castaneous, somewhat dextrorse; capsule large, the urn about 3.5 to 4 mm. long, strongly inclined to horizontal, arcuate, narrowly oblong, yellowish to castaneous; lid slenderly conic-rostrate, about 1.5 mm. long; annulus narrow, usually 2-seriate; peristome large, reddish, the teeth strongly and numerously trabeculate, often split at the hyaline and papillose apex, dorsally cross-striate below, the divisural and lamellæ distinct; segments about as long as teeth, carinately split, papillose above; the 2 or 3 slender nodose cilia rising from a basal membrane about one-third as high as the peristome; spores rather thin-walled, pale-castaneous, very slightly roughened, about .014–.017 mm., mature in winter.

On the ground, stones, rotten wood, stumps, etc.; in moist woods; Europe, Asia, and from Labrador to the Rocky Mountains and south to the West Indies and South America. Very common in the woods of our region.

Allegheny : Fourteen pockets, various data, from the county, mainly O. E. J. or O. E. J. and G. K. J.; Power's Run, September 14, 1905. O. E. J. and G. E. K. (Figured).

Armstrong : Kittanning, "Buttermilk Falls," August 22, 1903, and 1905. D. R. Sumstine; Kittanning, September 24, 1904. O. E. J.

Center : Tussey's Mt., above Shingletown, July 15, 1909. O. E. J.

Clinton : Between Renovo and Haneyville, July 15, 1908. O. E. J.

Crawford : Pymatuning Swamp, near Linesville, May 10-11, 1906, and August 3, 1909. O. E. J.

Fayette : Meadow Run Valley, four miles south of Ohio Pyle, September 1-3, 1906, September 1-3, 1907, May 30-31, 1908. O. E. J. and G. K. J.; Ohio Pyle, July 4, 1904, and May 14, 1905. O. E. J.

Indiana : Along Cush-Cushing Creek, near Cherry Tree, July 12, 1908. O. E. J.

McKean : Bennett Brook, Bradford, February 21, 1893, and Marilla Brook, October 22, 1896. D. A. B.

Westmoreland : Blairsville, July 12, 1903. Miss K. R. Holmes; slope of Chestnut Ridge above Hillside, September 16-17, 1910. O. E. J. and G. K. J.

3. **Thuidium recognitum** [Hedwig] Lindberg.

(*Hypnum recognitum* Hedwig; *T. delicatulum* Bryologia Europæa).

(Plate XXXVI)

Yellowish-green, not as bright-colored as some of the other *Thuidiums*, quite similar to the preceding but mostly bipinnate: the primary branches are nearly equal in length, thus making the general outline of the frond more linear-oblong; stem-leaves usually about 0.6 to 0.8 mm. long, broadly triangular, auriculate-cordate, abruptly acuminate, recurved-spreading when moist, the apex acute and often very slender, the serrulate margins usually plane, the leaves sulcate when dry; costa sub-percurrent, somewhat broadened at apex; leaf-cells incrassate, and each with a long, slender, upcurved dorsal papilla, the median rhombic-oblong to rounded-quadrate, the apical somewhat narrower; branch-leaves with apical cells with 2–4

papillæ; perichætial leaves up to 4.5 mm. long, slenderly long-acuminate, non-ciliate: seta about 2–2.5 cm. long, slender, castaneous, lustrous, dextrorse above; capsule oblong-cylindric, arcuate, more or less inclined, the urn castaneous, 2.5–3 mm. long, when dry quite sharply bent and constricted at the mouth; peristome as in *T. delicatulum;* annulus large, deciduous, pluri-seriate; lid short-rostrate; spores with yellowish, medium-thick, granular walls, about .012–.014 mm., mature in midsummer.

On the ground on rocks or on rotten wood in moist, shaded woods; Europe, Asia, northern Africa, and from northern Canada southeastward to Florida. Rather common in our region.

Allegheny : On clay bank under hemlocks, Wildwood Road Hollow, March 29, 1908. O. E. J. and G. K. J.; Guyasuta Hollow, October 25, 1908. O. E. J.

Armstrong : Kittanning, September 24, 1904. O. E. J. (Figured).

Clinton : Between Renovo and Haneyville, July 15, 1908. O. E. J.

McKean : Langmade Hollow, May 3, 1896, Toad Hollow, June 17, 1896, and Bolivar Run, July 17, 1897, all near Bradford. D. A. B.

11. *ELODIUM* (Sullivant) Warnstorf.

Autoicous or rarely dioicous: more or less robust, in deep, soft, slightly lustrous, green to yellowish-green or sometimes brownish tufts: stems elliptic in cross-section, without central strand, mostly simple, thickly-foliate, somewhat distichously pinnate; branchlets filiform; paraphyses small, branched, numerous; leaves all similar, when dry appressed, when moist erect-spreading, or erect, concave, with a dorsally projecting main plication; stem-leaves from a narrowed base suddenly lance-ovate, acuminate, the margin almost wholly revolute, mostly entire, sometimes apically serrate; costa incomplete, mostly small; cells pellucid, elongate-hexagonal to almost linear, smooth or unipapillate over the lumen or in the cell-angle, the basal cells laxly rectangular; branch-leaves smaller; perichætial leaves erect, pale, plicate, delicate, narrowly acuminate, incompletely costate: seta 2–5 cm. long, smooth; capsule inclined to horizontal, oblong-cylindric, brown, more or less arcuate; annulus revoluble; peristome-teeth broadly lance-subulate, yellow, basally confluent, transversely striate, apically almost smooth, hyaline-bordered, high-trabeculate, the plates numerous, and often forked or with transverse walls; inner peristome yellowish, almost smooth, with high basal membrane, carinate; segments as long as teeth, lance-subu-

late, entire or very narrowly carinately split, cilia 3, complete, delicate, smooth; lid convex-conic, acute; calyptra cucullate, glabrous; spores about .010–.016(–.024) mm.

A genus of four species, at least one of these in our region.

1. **Elodium paludosum** (Sullivant) Loeske.

(*Hypnum paludosum* Sullivant; *Thuidium paludosum* Jaeger and Sauerbeck).

(Plate XXXVI)

Yellowish-green, irregularly pinnate: primary stems creeping, branchlets distichous, unequal: stem-leaves somewhat rigid, about 1–1.5 mm. long, erect-spreading to somewhat appressed, lance-oblong, acuminate, somewhat cordate at base, concave below, reflexed on the borders, smooth on both faces, at the base bearing 1 to 3 paraphyllose branched filaments, the base decurrent, plicate-striate; costa sub-percurrent; median leaf-cells shortly linear-oblong to linear-rhomboid, usually smooth, sometimes dorsally lightly papillose at the distal end; stems and branches with numerous filamentous and branched paraphyllia; branch-leaves narrower, smaller, usually 0.6–0.8 mm. long; inner perichætial leaves oblong, gradually slenderly acuminate, up to 3 mm. long, longitudinally plicate: seta about 1.5–3 cm. long, slender, red-castaneous, dextrorse above; capsule oblong-cylindric, curved, strongly inclined to almost horizontal, about 3:1, the urn about 3–3.5 mm. long; lid conic, apiculate; peristome normally hypnoid, large, the teeth rather broadly lance-acuminate, densely trabeculate, the lower trabeculæ often forked and thus united by obliquely transverse bars, the dorsal lamellæ numerous and below densely cross-striate, yellowish; segments as long as teeth, carinate but rarely split, the basal membrane about one-third as high as teeth, the cilia 3, nodose or appendiculate above, nearly as long as segments; spores mature in winter, about .018–.022 mm., medium-walled, yellowish, granular; annulus large.

In wet, grassy fields, swamps, and bogs; Asia, and from New England to Ontario and south to Illinois and Delaware. Probably rather common in the northern part of our region.

Allegheny : Swampy ground near Douthett, about on boundary line of Butler and Allegheny Counties, April 26, 1908. O. E. J.

Butler : Swampy ground near Crider's Corners, April 26, 1908. O. E. J.

Crawford : Pymatuning Swamp, near Linesville, June 12, 1905. O. E. J. (Figured).

1*a*. **Elodium paludosum** variety **elodioides** (Renauld and Cardot) Best.

(*Thuidium elodioides* Renauld and Cardot).

Leaves smaller with margins dentate-serrate, the cells more or less strongly and often sub-centrally papillose; darker green; cells shorter, elliptic or oval.

In swampy meadows, swamps, bogs, etc.; from New York to Ohio and Indiana. Apparently rare in our region.

McKean : D. A. Burnett. Bradford.

Family XXXI. *HYPNACEAE.*

Autoicous or dioicous, rarely pseudautoicous or polyoicous: antheridial clusters gemmiform, small, archegonial clusters on short mostly rooting perichætial branches: slender to robust, variously cespitose, rarely floating, dull to lustrous: stem without central strand, mostly woody, often stoloniferous, mostly irregularly pinnate, but the branches often regularly pinnate; leaves pluriseriate, unistratose, erect-spreading to squarrose, rarely densely imbricate, often secund or circinate, of various forms, sometimes unsymmetric; costa homogeneous, mostly thin and rather short, simple, double, forked, or none, rarely strong and complete to excurrent; leaf-cells mostly narrowly prosenchymatous, rarely parenchymatous, at the base looser, the alar mostly differentiated into a distinct group, rounded to oval or 4–6-sided, small to inflated, mostly hyaline: seta elongated, mostly smooth; capsule mostly inclined to horizontal, mostly arcuate, rarely pendent, or erect, mostly smooth; collum scant; peristome double, both parts of same length, teeth lance-subulate, mostly strongly hygroscopic, mostly confluent at base, rarely separate, yellow, red-brown to purple, mostly transversely striate, with divisural zigzag, with trabeculæ numerous and well-developed; basal membrane of inner peristome wide, segments keeled, mostly lance-subulate, cilia mostly complete, filiform, nodose to articulate, rarely rudimentary or none; lid usually conic-convex, in our species obtuse to acute or shortly rostrate; spores small.

A large and cosmopolitan family of 37 genera, distributed on all kinds of substrata.

Key to the Genera.

a. Costa in our species single, extending to leaf-middle or beyond; lid never rostrate. d. (*Amblystegieae*).

a. Costa short and double or none; lid sometimes rostrate. b.

b. Stem-leaves and branch-leaves usually distinctly dissimilar, symmetric and normally inserted. o. (*Hylocomieae*).

b. Stem- and branch-leaves more or less closely similar, often inserted obliquely and unsymmetrically. c.

c. Leaves either symmetric and normally inserted or unsymmetric and obliquely inserted; lid sometimes rostrate. s. (*Stereodonteae*).

c. Leaves obliquely inserted and apparently two-ranked, mostly unsymmetric; branches mostly complanate; lid conic to short-rostrate, rarely long-rostrate. t. (*Plagiothecieae*).

d. Leaves bordered. 5. *Sciaromium.*

d. Leaves non-bordered. e.

e. Costa strong, sub-percurrent, or sometimes excurrent. f.

e. Costa not reaching leaf-apex. j.

f. Paraphyllia numerous, polymorphic; leaves non-plicate. 4. *Hygroamblystegium.*

f. Paraphyllia none or scarce. g.

g. Leaf-cells linear-vermicular to the leaf-base, mostly with blunt ends, alar cells forming a small, distinct, well-defined group of quadrate or rectangular cells. 9. *Hygrohypnum.*

g. Leaf-cells hexagonal and 2–6-times as long as wide, or prolonged-linear and becoming wider and shorter basally, alar cells forming a group which is large and often extends to the costa. h.

h. Alar cells parenchymatous. 6. *Drepanocladus.*

h. Alar cells prosenchymatous. i.

i. Leaf-cells prolonged-linear. 7. *Calliergon.*

i. Leaf-cells prosenchymatous-hexagonal, 2–6 times as long as wide. 4. *Hygroamblystegium.*

j. Leaves cordate to ovate-lanceolate, acuminate; costa weak, reaching the middle of leaf or beyond; leaf-cells rarely linear, mostly parenchymatous and 4-sided or prosenchymatous and 6-sided. 1. *Amblystegium.*

j. Characters not combined as above. k.

k. Leaf-cells narrowly linear; leaves broadly ovate or cordate, with reflexed-squarrose and subulate-acuminate tips. 10. *Campylium.*

k. Leaf-cells and leaves not as above. l.

l. Leaves oval to oblong-lanceolate, long-acuminate; cells narrowly prosenchymatous; plants shining. 3. *Homomallium.*

l. Not as above. m.

m. Slender, dull; leaves spreading, lanceolate to lance-linear; cells rhomboidal to long-hexagonal, 2–6 or rarely 6–8 times as long as broad. 2. *Amblystegiella.*

m. Leaf-cells prolonged-linear, mostly very narrow. n.

n. Leaves erect-spreading to imbricated, oblong-ovate to rounded, obtuse or apiculate, often deeply concave; costa short and double or none. 8. *Acrocladium.*

n. Leaves more or less falcate-secund to circinate, from a mostly narrowed and somewhat decurrent base becoming ovate- to triangular- or cordate-lanceolate, more or less slenderly acuminate, costa weak, reaching about to leaf-middle or even in some cases excurrent. 6. *Drepanocladus.*

o. Paraphyllia numerous; leaves more or less erect, from abruptly to shortly acuminate, mostly plicate. 14. *Hylocomium.*

o. Paraphyllia none or very few. p.

p. Stem-leaves more or less squarrose-spreading to secund, acuminate. r.

p. Stem-leaves more or less crowded, imbricate, but with more or less spreading to secund tips. q.

q. Stem-leaves turgidly imbricate and secund, rugose, narrowly lance-acuminate from a broadly oblong base, glossy; apex serrate: cilia two; annulus present. 13. *Rhytidium.*

q. Stem-leaves close, or loosely imbricate, not secund, broadly ovate or rounded and with an obtuse apex, olive or grayish-green, apex finely crenulate: cilia three; annulus none. 15. *Hypnum.*

r. Alar cells little or not at all differentiated; plants distantly and irregularly pinnate; leaves squarrose or spreading and secund. 12. *Rhytidiadelphus.*

r. Alar cells distinctly differentiated; plants closely pinnate; leaves circinate-secund. 11. *Ctenidium.*

s. Plants large, to 15 cm. tall, closely and regularly pinnate; leaves linear-acuminate from a broadly ovate base, stem-leaves plicate, falcate-secund: cilia 3 or 4. 16. *Ptilium.*

s. Plants robust to quite slender, simple or pinnate, mostly irregularly pinnate; leaves ovate- to cordate-lanceolate, shortly to slenderly acuminate, generally circinate-secund in two series. 17. *Stereodon.*

t. Leaf-cells very narrowly prosenchymatous, alar cells mostly not differentiated; leaves oblong to linear, short-pointed, ovate to linear-lanceolate, acute to long-acuminate or piliferous. 18. *Isopterygium.*

t. Leaf-cells wider, alar cells broader proportionally, hyaline and thin-walled; leaves broadly lanceolate to oval, more or less long-acuminate. 19. *Plagiothecium.*

1. *AMBLYSTEGIUM* Bryologia Europæa.

Autoicous: usually more or less slender, in thin and spreading mats: stem creeping to ascending or even erect, irregularly to pinnately branched, the branches mostly more or less erect; stem-leaves similar to branch-leaves, erect-spreading to squarrose, mostly shortly decurrent, cordate- to ovate-lanceolate, long-acuminate, rather concave, non-plicate, entire to serrate; costa thin, simple, reaching to the middle of the leaf or beyond, rarely complete; cells parenchymatous and rectangular to elongate-prosenchymatous and hexagonal, rarely linear, smooth, the alar quadrate to rectangular, the inner perichætial leaves erect, broadly lanceolate, mostly costate: seta long, thin, reddish to castaneous, flattened when dry; capsule, from an erect collum, curved to oblong or cylindric, smooth when dry, constricted below the expanded mouth, annulate; peristome-teeth basally confluent, yellow to orange, lance-subulate, bordered, dorsally cross-striate, above pale and papillose, densely trabeculate below; inner peristome yellowish, basal membrane high; segments carinate, entire, or slightly gaping along the keel; cilia complete, nodose, rarely appendiculate; lid conic, obtuse to acute; spores small.

A genus of about 50 species occurring mainly in temperate regions, on various sub-strata; about 20 species in North America; six in our range.

Key to the Species.

a. Stem-creeping; leaves erect-spreading; median leaf-cells about 2–6:1. b.

a. Stem often ascending or erect; leaves mostly widely to squarrosely spreading; median leaf-cells mostly 4–8:1, or rarely 10–15:1. f.

b. Cells in middle of leaf about 2–4:1. c.

b. Cells in middle of leaf about 4–6(–8):1. e.

c. Very slender; costa thin, ending near the middle of the leaf. 1. *A. serpens.*

c. Less slender; costa stronger, almost reaching apex. d.

d. Stem-leaves ovate-acuminate, acute, slenderly acuminate. 2. *A. varium.*

d. Stem-leaves ovate-cordate, abruptly narrowed to a rather blunt acumination. 3. *A. orthocladon.*

e. Costa reaching to three-fourths the length of the leaf. 4. *A. juratzkanum.*

e. Costa reaching about to the middle of the leaf. 5. *A. radicale.*

f. Slender: median leaf-cells prosenchymatous, hexagonal to linear, 4–8(–10):1. 6. *A. kochii.*

f. Rather robust: median leaf-cells elongate-prosenchymatous to linear, 5–10(–15):1. 7. *A. riparium.*

1. **Amblystegium serpens** [Linnæus] Bryologia Europæa.

(*Hypnum serpens* Linnæus)

(Plate XXXVII)

Dull, more or less yellowish-green, very small and slender, forming thin, soft, densely interwoven mats: stems prostrate, radiculose, irregularly branching, the branches ascending or spreading or erect; leaves rather crowded, when moist variously spreading, when dry more or less appressed and imbricate; stem-leaves lance-ovate to ovate-acuminate, usually long-acuminate, the largest about 0.8–1.0×0.4–0.5 mm., often much smaller, narrowed and decurrent at base, slightly denticulate or entire, somewhat concave, the margins plane; costa usually reaching about to the middle of the leaf or above, often quite faint and indistinct; branch-leaves similar but smaller and narrower, usually more lanceolate; median leaf-cells oblong- to rhomboid-hexagonal, about 2–4:1, the basal broader and more rectangular, the alar quadrate to transversely elongate but not forming a well-defined group, some of the apical considerably longer; perichætial leaves lanceolate, thin, plicate, up to 1.5 mm. long: seta rather slender, 1–3 cm. long, reddish, dextrorse; capsule cylindric, the urn about 1.5 mm. long, strongly curved, cernuous, constricted below the mouth when dry; lid convex-conic, rather obtusely apiculate; peristome rather large for the capsule, typically hypnaceous, teeth pale castaneous, strongly trabeculate, below dorsally cross-striolate, the dorsal lamellæ projecting to form a more or less crenate hyaline margin; segments about as long as teeth,

carinately split, rising from a basal membrane about two-fifths as high, the cilia 1 (sometimes 2 or 3), as long as segments, slender, nodose to appendiculate; annulus 2–3-seriate; spores papillose, when mature brownish or yellowish, medium-walled, about .014–.018 mm., mature in spring: autoicous.

On bases and roots of trees, decaying logs, soil, rocks, etc., in moist woods; cosmopolitan; in North America occurring from the Arctic regions to the Gulf of Mexico. Fairly common in our region.

Allegheny	: Wildwood Road Hollow, June 11, 1908, on base of white oak, Guyasuta Hollow, October 25, 1908, and Douthett, December 29, 1908. O. E. J.
Beaver	: Beaver Falls, May 14, 1907, Crider's Corners, December 29, 1908. O. E. J.
Cambria	: Lloydsville, July 22, 1908. O. E. J.
Crawford	: Linesville, May 12, 1908. O. E. J.
Erie	: Presque Isle, June 8-9, 1906. O. E. J.
Fayette	: Meadow Run Valley, four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J. (Figured).
Westmoreland	: Slope of Chestnut Ridge above Hillside, September 16-17, 1909. O. E. J. and G. K. J.

2. **Amblystegium varium** (Hedwig) Lindberg.
(*Leskea varia* Hedwig; *Stereodon varius* Mitten; *Hypnum debile* Bridel).

(Plate XXXVII)

More or less loosely cespitose, green to light-green above, darker below, the stems and branches similar but larger than in *A. serpens;* leaves rather close together, erect- to widely-spreading, the stem-leaves ovate-acuminate, the largest about 1–1.5 mm.×0.5–0.7 mm., usually long-acuminate, somewhat concave, the margins entire or very slightly denticulate, plane, the base very slightly decurrent; branch-leaves similar but smaller and more lance-ovate, usually about 0.6–0.8×0.3–0.4 mm.; costa strong, more or less colored, usually yellowish or brownish, reaching usually into the acumen; median leaf-cells rhomboid-hexagonal, usually about 2–4:1, somewhat incrassate, rather regularly arranged, the basal larger and more incrassate, sometimes yellowish, short-rectangular, the basal marginal distinctly quadrate; inner perichætial leaves slenderly lance-triangular, about 1.6 mm. long; seta reddish, slender, dextrorse, varying from 1–2 cm. in length; capsule reddish-yellow, about 4–6:1, cylindric, arcuate, the urn about 1.3 mm. long, rather smooth, even when dry and empty; annulus 2–3-seriate; peristome typically hypnaceous, similar to that of

A. serpens, the teeth basally confluent, dorsally cross-striolate below, hyaline-papillose above, strongly and closely trabeculate; the segments about as long, slightly carinately cleft, the basal membrane about two-fifths as high, the cilia 1 or 2, nodose to shortly appendiculate; lid conic-acute; spores about .012–.018 mm., slightly papillose, medium-walled, mature in late spring: autoicous.

On bases of trees, soil, rocks, rotting wood, etc., in moist woods; Europe, and, in North America, from Canada to the Gulf of Mexico. Very common in our region.

Allegheny : Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J.; on rocks, Power's Run, May 10, 1905; Wildwood Road Hollow, June 6, 1908; Fern Hollow, Pittsburgh, June 18, 1907, and Guyasuta Hollow, November 9, 1908. O. E. J.; Kennywood, May 3, 1902, and Moon Township May 18, 1902. J. A. S.

Beaver : Beaver Falls, May 14, 1907. O. E. J.

Butler : On base of *Crataegus punctata,* Crider's Corners, December 29, 1908. O. E. J.

Crawford : Linesville, June 11-12, 1907, and May 12, 1908. O. E. J.

Erie : Presque Isle, June 8-9, 1906. O. E. J.

Fayette : Four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J., and September 1-3, 1907; Ohio Pyle, May 30-31, and July 4, 1908. O. E. J.

Lawrence : On log, New Castle. Miss Susan Gageby, 1906.

Somerset : Ursina, May 12, 1905. O. E. J.

Washington : Hanlin, on wet log, May 21, 1908. O. E. J.

Westmoreland : Laurelville, May 30-31, 1903. J. A. S.; "Shades," near Blackburn, June 13, 1908, Hillside, May 22, 1909, and Garrett Farm, near Trafford, August 21, 1910. O. E. J.; slope of Chestnut Ridge above Hillside, September 16-17, 1909. O. E. J. and G. K. J. (Figured).

3. **Amblystegium orthocladon** (Beauvois) Jaeger.

(*Hypnum orthocladon* Beauvois; *A. varium* var. *orthocladon* Husnot).

(Plate XXXVII)

Rather dark-green, sometimes olive-green, rather stiff when dry, compactly tufted: stems irregularly branching, the branches of plants in the denser tufts often erect, usually less

than 1.5 cm. long; leaves up to 1 mm. long, broadly cordate-ovate, usually rapidly and uniformly narrowed to an acute or sub-obtuse apex, rounded to a narrow base, slightly concave, slightly decurrent, widely spreading both wet and dry, the margins plane and minutely serrulate; costa strong, wide at base, yellowish, usually extending up into the apex; leaf-cells sub-incrassate, the median oblong-rhomboidal with rounded ends, about 2–4(–6):1, the apical similar, the median basal oblong-rectangular, the cells of the angles somewhat wider, varying to short-rectangular or quadrate, incrassate, often opaque or colored: seta about 1–1.5 cm. long, castaneous, dextrorse; capsule castaneous, oblong-cylindric, arcuate, cernuous, constricted below the rim when dry, narrowed at base to distinct neck, the urn about 1.6–1.9 mm. long; peristome typically hypnoid; spores mature in spring, somewhat incrassate, minutely roughened, about .010–.012 mm.

On stones, rotten wood, bases of trees, etc., along brooks or in moist situations in woods; Europe, and from lower Canada to the Gulf of Mexico. By many authors regarded as a variety of *A. varium*, but in our region quite common and well marked.

Allegheny	: Power's Run, May 7, 1905, and May 17, 1907, Fern Hollow, August 26, 1906, and Darlington Hollow, October 25, 1908. O. E. J.
Crawford	: Linesville, May 12, 1908. O. E. J.
Fayette	: Cheat Haven, September 26, 1910. O. E. J. and G. K. J. (Figured).
Greene	: Waynesburg, May 30, 1904. O. E. J.
McKean	: Bennett Brook, July 15, 1893. D. A. B.
Washington	: Library P. O., April 22, 1906, Hanlin, May 21, 1908.
Westmoreland	: Hillside, May 19, 1906, and May 22, 1909, and Trafford City, June 13, 1908. O. E. J.

4. **Amblystegium juratzkanum** Schimper.

(Plate XXXVII)

Light yellowish-green, small: stems prostrate, rooting, slender, the branches irregularly disposed, often ascending to erect, and rising to a height of 1–1.5 cm.; leaves when moist irregularly spreading to widely squarrose-spreading, when dry spreading to squarrose-spreading and shriveled, ovate-lanceolate, gradually acuminate, about 1 to 1.4 mm. long by 0.5 mm. wide but quite variable, almost entire to minutely denticulate, plane, the base narrowed, decurrent and slightly concave; costa yellowish, fairly strong, reaching to the middle or somewhat further; median leaf-cells prosenchymatous, linear-hexagonal, about 4–8:1, moderately incrassate, hyaline, the apical

similar, the basal tending to sub-quadrate or shortly rectangular, the alar forming a rather distinct group, sub-pellucid, 2–3 times as wide as the median cells, decidedly incrassate, and always as long or longer than wide, perichætial leaves 1.5–2 mm. long, acuminate, thin, plicate: seta castaneous, smooth, about 2–2.5 cm. high, when dry flattened, flexuous, dextrorse; capsule unsymmetric, cernuous, decidedly arcuate, often describing a half-circle, about 1.5–2.0 mm. long, smooth, reddish, when dry and empty much contracted below the wide mouth; peristome typically hypnoid; teeth reddish, pellucid, strongly articulate and trabeculate, confluent slightly at base, hyaline-margined, divisural zigzag, dorsal cross-striæ evident; segments as long as the teeth, sub-entire, reddish-yellow, carinate, not at all or but slightly split, cilia 1–3, of equal length, or some shorter, nodose, united a little below the middle with the segments to form the basal membrane; spores rather clear, minutely papillose, medium to rather thin-walled, mature in spring, .010–.012 mm. in diameter.

On moist soil and stones; Europe, Asia, and, in North America, from Canada to the Gulf of Mexico. Rather common in our region. This species is intermediate between *A. serpens* and *A. kochii*, but from the former differs in the more squarrose-spreading leaves, longer alar cells, and stronger costa, while from the latter it differs mainly in smaller size and longer-pointed leaves.

Allegheny	: Douthett, June 5, 1909, Fern Hollow, Pittsburgh, April 25, 1909, Power's Run, May 7, 1905, Nine-Mile Run, May 17, 1907. O E. J.; Moon Township, May 18, 1902, and Laschell Hollow, June 15, 1902. J. A. S.
Crawford	: Linesville, in Pymatuning Swamp, June 11-12, 1907, and May 12, 1908. O. E. J. (Figured).
Erie	: Presque Isle, June 9-11, 1905. O. E. J.
Fayette	: Ohio Pyle, September 1-3, 1906. O. E. J.

5. **Amblystegium radicale** [Beauvois] Mitten.

(*Hypnum radicale* Beauvois; *H. bergenense* Austin; *Campylium radicale* Grout).

(Plate XXXVIII)

Loose, slender, pale-green, little branched, the branches often erect and up to 2 cm. or more long; branch-leaves distant, spreading to somewhat squarrose, lanceolate- to ovate-cordate, up to 1.5×0.7 mm., concave at base, entire or almost so, decurrent, abruptly slenderly acuminate; median leaf-cells about 4–8:1, sometimes longer, medium-walled, the alar sometimes

more abruptly enlarged and hyaline; costa well developed, orange, up to two-thirds or three-fourths as long as the leaf; perichætial leaves slenderly acuminate and up to 2.5 mm. long, plicate, erect: seta up to 3 cm. long, castaneous, strong, dextrorse; capsule yellowish, the urn about 2.7 mm. long, arcuate, oblong-cylindric, contracted below the mouth when dry; peristome-teeth strong, castaneous, strongly trabeculate, hyaline-margined, the dorsal lamellæ cross-striolate below, papillose and hyaline above; segments entire or nearly so, about as long as teeth, the basal membrane about two-fifths as high as teeth; cilia 2 or 3, usually one, at least, as long as the segments, nodose, hyaline, minutely papillose; annulus usually 2-seriate; exothecial cells rounded-quadrate above to rectangular-hexagonal below; spores castaneous, minutely papillose, medium-walled, about .016–.019 mm., mature in spring.

On rotten logs, roots of trees, wet soil, etc., in wet, shaded places: Europe, Asia, and apparently well distributed throughout temperate North America. The species occurs in Eastern Pennsylvania and has been found once in our region.

McKean : In springy places near Bradford, May 17, 1895. D. A. B. (Figured).

6. **Amblystegium kochii** Bryologia Europæa.

(Plate XXXVIII)

Stem prostrate with short erect or ascending branches, the branches not usually reaching more than 5 or 6 mm. long, the general color of the loose mats being pale green to deep green: stem- and branch-leaves very similar, spreading rather widely or almost squarrose, erect-spreading when dry, cordate-ovate, narrowed but scarcely decurrent at base, the apex long and slenderly acuminate, the leaves sometimes narrower and more lanceolate but always long-acuminate, usually 1–1.5 mm. long, entire to faintly serrulate, plane-margined; costa medium strong, yellowish, usually about three-fourths as long as the leaf; median leaf-cells more or less chlorophyllose, thick-walled, rhomboid-hexagonal, the ends blunt or parenchymatous, about 4–6:1 or longer, the basal wider, the alar rectangular to rounded-quadrate, quite densely incrassate, hyaline or colored, but scarcely forming distinct alar patches; perichætial leaves up to 2 mm. long, lance-linear, long-acuminate: seta about 1.5–2 cm. long, castaneous, flexuous, dextrorse; capsule hypnoid, similar to that of *A. serpens*, the urn oblong-cylindric, inclined to cernuous, arcuate, about 2–2.5 mm. long, contracted below the mouth when dry; peristome-teeth brownish or yellowish, hyaline and papillose above, cross-striolate below, hyaline-margined, strongly and closely trabeculate, the dorsal lamellæ and divisural plain; segments about as long as the

teeth, slightly carinately split, the basal membrane about two-fifths as high; cilia usually 3, pale, papillose, some of them as long as the teeth, nodose; annulus rather large, two-seriate; upper exothecial cells small, rounded-hexagonal or quadrate, below becoming elongate-hexagonal or oblong-rectangular; spores in late spring or early summer, somewhat incrassate, castaneous, minutely roughened, about .015–.018 mm.

On moist earth in swampy or marshy places; Europe, Asia, and probably throughout temperate North America. Fairly common in our region but in its smaller sizes difficult to satisfactorily distinguish from *A. juratzkanum*.

Allegheny	: On wet woods-humus, Guyasuta Hollow, October 12, and October 25, 1908. O. E. J.; Kennywood, May 3, 1902, Moon Township, May 18, 1902. J. A. S.
Center	: On wet, clayey soil in Barrens near Scotia, July 14, 1909. O. E. J.
Crawford	: Linesville, Pymatuning Swamp, June 12, 1907. O. E. J.
Fayette	: Ohio Pyle, June 11, 1908. O. E. J.
Lawrence	: New Castle, 1906. Miss Susan Gageby.
McKean	: West Branch Swamp, November 15, 1899. D. A. B.
Washington	: On damp roots of black walnut, Hanlin, May 21, 1908. O. E. J.
Westmoreland	: On wet rocks at edge of stream, Hillside, May 19, 1906, and Garrett Farm, near Trafford, August 21, 1910. O. E. J.

7. **Amblystegium riparium** [Linnæus] Bryologia Europæa.

(*Hypnum riparium* Linnæus; *H. laxifolium* Bridel; *Stereodon riparium* Mitten).

(Plate XXXVIII)

Loosely cespitose, yellowish-green, the flat tufts soft: stems creeping, sub-pinnate, the branches usually 2 or 3 cm. long, spreading to horizontal, the stems sometimes floating and reaching a length of 8 or 10 cm.; stem-leaves 2–4 mm. long, rather widely spreading or almost squarrose both wet and dry, often somewhat complanate, at tips of branches more or less secund, widely lance-ovate to oblong-lanceolate, gradually tapering to a fine, flat, non-channeled acumination, shortly decurrent, rounded at base, non-auriculate, somewhat excavate; branch-leaves similar but smaller, all leaves entire and plane-margined; costa fairly strong, reaching from one-half to three-fourths the length of the leaf; median leaf-cells linear-rhomboid, prosenchymatous, usually 8–12(–15):1, thin-walled, chlorophyllose, towards the base lax and sub-rectangular, at

the angles often somewhat larger, rectangular, and sub-inflated, but not forming very distinct nor hyaline patches: seta usually 1–2 cm. long; capsule rather turgid, oblong-cylindric, arcuate, inclined; peristome hypnoid but relatively rather large; teeth dark orange, cilia 2 or 3, appendiculate, about as long as the entire or slightly parted segments, the basal membrane reaching to about two-fifths as high as the peristome; annulus 2–3-seriate; exothecial cells very much smaller at rim, below becoming irregular to rectangular, medium-walled; spores minutely roughened, .011–.014 mm., mature in spring: autoicous.

In swamps, springs, brooks, etc., on bases of trees, roots, stones, etc., sometimes floating; almost cosmopolitan; in North America ranging from the Arctic regions to Louisiana and Cuba. Common in our region, in suitable habitats.

Allegheny : Fern Hollow, August 20, 1906, and Nine-Mile Run, near Swissvale, May 17, 1907. O. E. J.

Beaver : Beaver Falls, May 14, 1907. O. E. J. (Figured).

Center : In swampy spot in gap of Bald Eagle Mt., near Matternville, September 20, 1909. This latter specimen has slenderly acuminate leaves approaching var. *longifolium* (Schultz) Bryologia Europæa.

7a. **Amblystegium riparium** variety **flaccidum** (Lesquereux and James) Renauld and Cardot. (Plate XXXVIII)

Smaller and of a more slender habit; leaves more distant and tending to sagittate-lanceolate.

McKean : East Branch swamp, near Bradford, June 15, 1895. D. A. B. (Figured).

2. *AMBLYSTEGIELLA* Loeske.

Autoicous or dioicous: very slender, stems filiform, mostly creeping, irregularly branched; leaves rather laxly disposed, erect-spreading or rarely weakly secund, lanceolate to lance-subulate from a sometimes somewhat decurrent base, slightly concave, non-plicate, margin plane and entire; costa none or very short and weak; median leaf-cells rhomboid-hexagonal or oblong-hexagonal, 2–4(–8):1, the basal rather lax, parenchymatous, the alar quadrate; inner perichætial leaves erect, basally sheathing, lanceolate to lance-oblong, long-acuminate, ecostate, or with the costa ending in or above mid-leaf: seta 5–12 mm. long, drying flattened, yellowish-red to castaneous; capsule mostly erect and symmetric, rarely secund and cernuous, obovate to oblong-cylindric, when dry and empty constricted below the wide mouth, smooth; annulus present; peris-

tome-teeth narrowly lance-ovate, basally confluent, yellowish, bordered, dorsally cross-striate, above pale and papillose, densely trabeculate below; inner peristome pale or yellow, basal membrane high, segments entire or but slightly split, cilia rarely 1–3 and complete, mostly solitary and rudimentary or none, non-appendiculate; lid high-convex, obtuse to acute; spores small.

A genus of 8 species, confined to the Northern Hemisphere, occurring on trees and rocks; 5 species in North America; two species occurring in our range.

Key to the Species.

a. Inner perichætial leaves irregularly toothed above; leaves not narrowed to insertion; alar cells longer than broad. 1. *A. minutissima.*

a. Inner perichætial leaves entire; leaves narrowed to the insertion; alar cells quadrate. 2. *A. confervoides.*

1. **Amblystegiella minutissima** (Sullivant and Lesquereux) Nichols.

(*Hypnum minutissimum* Sullivant and Lesquereux; *Amblystegium minutissimum* Jaeger).

Minute, pale green: stems prostrate, short, up to about 1 cm. long, with radicles in fascicles, the branches occurring subpinnately and spreading to erect; leaves loose, narrowly triangular-lanceolate, broadest and not narrowed at base, 3–4 mm. long, more or less serrulate, ecostate or very faintly marked with striæ; leaf-cells large, oblong, about 4–8:1, the marginal alar cells about 2:1; capsule minute, about 0.5 mm. long, ovoid, symmetric or slightly curved, constricted below the mouth and turbinate when dry and empty, thin-walled, yellowish; seta slender, 4 or 5 mm. long; teeth yellowish, hyaline-bordered; cilia as long as segments and 1 or 2 in number; annulus 2-seriate, persistent; lid conic, apiculate-rostrate, about one-half as long as urn.

On rocks and stones in shaded ravines, said to prefer limestone, from New Jersey and Pennsylvania westward to Illinois, Ontario, the Rocky Mountains and British Columbia. Rare in our region.

Huntingdon : Alexandria. T. C. Porter. (Porter's Catalogue).

2. **Amblystegiella conferva** (Schwægrichen) New Combination.

(*Hypnum confervoides* Bridel; *A. confervoides* Loeske; *Hypnum conferva* Schwaegrichen).

Dark green, minute; stems irregularly branching, about 0.5–1.0 cm. long; leaves very small, about 0.2–0.4 mm. long, rather distant, more or less appressed both wet and dry, entire or almost so, ovate, acuminate, ecostate; leaf-cells irre-

gularly quadrate-rhomboid to oblong-hexagonal, ranging from 1–3:1, some of them wider transversely, the apical shorter than the median, the alar numerous and quadrate to transversely elongate: capsule cernuous, reddish-brown, more or less curved, oblong, minute; peristome perfect with double cilia or sometimes 3; spores mature in summer: autoicous.

Mainly on shaded ledges of limestone; Europe, Asia, and, in North America from New Brunswick to southeastern Pennsylvania and westward to the Rocky Mountains. Rare in our region.

Huntingdon: On limestone rocks, one mile south of Pennsylvania Furnace, July 13, 1909. O. E. J.

3. *HOMOMALLIUM* (Schimper) Loeske.

Autoicous: slender, rarely somewhat robust, light to brownish or yellowish-green, more or less shining; stems creeping, divided and irregularly pinnately branched, with the branches short, erect, and more or less curved; leaves erect-spreading or secund above, the lower mostly straight, the upper often curved, concave, non-plicate, oval- to oblong-lanceolate, the base narrowed and but little decurrent, apex elongate-subulate, the margins plane, entire or serrate at apex; costa none or short, thin, and double, or longer and sometimes forked; leaf-cells narrowly prosenchymatous, smooth or with projecting ends, towards the base shorter and a little wider, the alar numerous, small, quadrate, green, passing rapidly into the narrower cells above; inner perichætial leaves almost sheathing, abruptly acuminate: seta 1–2 cm. long, thin, compressed, reddish; capsule inclined to horizontal, oblong, when dry and empty strongly curved and narrowly constricted below the mouth; annulus revoluble; peristome-teeth yellow, basally confluent, dorsally cross-striate, bordered, pale and papillose above, trabeculæ numerous and close below, above strongly projecting, inner peristome yellowish, papillose, and with a high basal membrane, segments keeled, split, cilia 2–3, papillose, nodose; spores small; lid shortly and acutely rostrate.

A genus of about 8 species, occurring on rocks and tree-trunks; 2 species in North America; 1 species in our region.

1. **Homomallium adnatum** (Hedwig) Brotherus.

(*Hypnum adnatum* Hedwig; *Amblystegiella adnata* Nichols; *Stereodon adnatum* Mitten).

(Plate XXXIX)

Widely cespitose in thin, closely adherent mats, pale green, or yellowish-green, darker below: stems irregularly branching, creeping, the branches close, short; leaves close, erect-spreading, ovate or oblong, shortly and widely acuminate to

slenderly acuminate, entire or nearly so, concave, ecostate or slightly bi-striate at base, the margins often more or less recurved below, the leaves 0.6–1.0 mm. long; median leaf-cells somewhat pellucid, sub-rhomboidal, prosenchymatous, about 4–8:1, the apical often shorter, the alar numerous, smaller, more incrassate and opaque, quadrate and extending along the margin to one-fourth or one-third the length of the leaf; outer perichætial broadly ovate, narrowly gradually acuminate, spreading, the inner oblong, erect, more abruptly acuminate, dentate, and costate nearly to the middle: seta erect, 1.5–2 cm. long, dextrorse; capsule arcuate, oblong, narrowed to a distinct neck, cernuous, reddish or yellowish, when dry constricted below the mouth but not wrinkled; lid paler, acutely conic; annulus present; exothecial cells rounded-hexagonal near the rim, rectangular below; peristome perfect, the teeth prominently and numerously trabeculate, hyaline and papillose apically, hyaline-margined and dorsally cross-striolate below, the segments entire and very slightly split, about as long as the teeth, the cilia about as long, hyaline and slightly papillose, the basal membrane about two-fifths as high; spores rather incrassate, pale-castaneous, papillose, .009–.012 mm., mature in summer.

On rocks and on bases of trees in woods; Asia and from lower Canada to North Carolina and Texas. Fairly common in our region.

Allegheny : Schenley Park, Pittsburgh, August 20, 1905, and on base of *Acer saccharum*, Guyasuta Hollow, November 8, 1908. O. E. J.

Fayette : Ohio Pyle, May 30-31, 1908. O. E. J. and G. K. J.

Huntingdon : On limestone rocks, Pennsylvania Furnace, July 13, 1909. O. E. J. (Figured).

McKean : On base of tree, Hawkins' Hollow, Bradford, October 18, 1895. D. A. B.

Westmoreland : On soil in woods, Hillside, May 22, 1909. O. E. J.

4. *HYGROAMBLYSTEGIUM* Loeske.

Autoicous or dioicous: slender to quite robust, mostly stiffly cespitose, dark-green to blackish-green, dull: stem more or less elongate, mostly floating, rarely more or less erect, mostly rather regularly pinnate, with forward-directed, rarely erect, mostly simple branches; leaves close, spreading to secund, concave, non-plicate, not at all or but slightly decurrent, rarely long-decurrent, mostly ovate to oblong-lanceolate, long-acuminate, margins plane, entire or remotely indistinctly denticulate; costa strong, short or percurrent, sometimes thickly excurrent; cells green, prosenchymatous, hexagonal,

2–4(–6):1, alar cells more or less plainly differentiated; costa complete or sub-percurrent: seta elongate, castaneous; capsule inclined to horizontal, early symmetric or somewhat dorsally gibbous, oblong-cylindric, later more or less arcuate, when dry and empty constricted below the mouth; peristome-teeth dark-yellow to orange, more or less basally confluent, lance-subulate, broadly bordered, dorsally cross-striate, apically pale and papillose, the margin step-like, the trabeculæ strongly projecting; inner peristome yellow, finely papillose, with high basal membrane, segments mostly carinately split, cilia complete, nodose to short-appendiculate; lid high-convex and apiculate or acute; spores small.

A genus of about 13 species, in damp places or in water, mostly in temperate or cooler regions; 5 species occur in North America; at least 3 species occurring in our region.

Key to the Species.

a. Leaves non-decurrent, entire or indistinctly and remotely serrate. b.
a. Leaves mostly decurrent, mostly with small but distinct teeth. c.
b. Leaves rather obtuse. 1. *H. fluviatile.*
b. Leaves more or less sharply acute. 2. *H. tenax.*
c. Costa sub-percurrent to percurrent. 3. *H. filicinum.*
c. Costa excurrent. d.
d. Leaves decurrent, auriculate, basally excavate. (*H. fallax* (Bridel) Brotherus).
d. Leaves non-decurrent, non-auriculate, not basally excavate. (*H. noterophilum* (Sullivant) Warnstorf).

1. **Hygroamblystegium fluviatile** [Swartz] Loeske.

(*Amblystegium fluviatile* Bryologia Europæa; *Hypnum fluviatile* Swartz).

(Plate XXXIX)

Robust, aquatic, floating in flat and elongated tufts, soft, olive- to dark-green, devoid of leaves below: stems with few branchlets, long, the branchlets more or less parallel and scarcely pinnate; leaves oblong-lanceolate to oblong-ovate, not markedly narrowed below, rather remote, erect-spreading, especially when dry, non-decurrent, gradually tapering to a short, blunt point, entire or very faintly serrulate, very concave, the margins more or less recurved at base; costa thick and strong, yellowish, ending in the apex; median leaf-cells loose, hexagonal-rhomboid, about 3–6:1, the basal cells rectangular, pellucid, sometimes somewhat opaque, strongly incrassate, not forming auricles, sometimes quite orange; perichætial leaves erect, strongly costate: seta about 1.5 cm. long, castaneous, dextrorse; capsules about 2.5 mm. long, oblong-cylindric, suberect, sub-arcuate, rather thick-walled, yellowish-brown, when

dry and empty strongly arcuate and constricted below the mouth; below the 2–3-seriate annulus the exothecial cells small and rounded-quadrate; peristome slightly inserted, teeth strongly confluent at base, dorsally cross-striolate, brownish below, apically hyaline and papillose; segments about as long as teeth, carinately split, the three nodose cilia about as long, the basal membrane about two-fifths to one-half as high as teeth; spores medium-walled, minutely papillose, brownish, about .016–.019 mm., mature in early summer.

On earth and on rocks and stones in running water, usual ly in non-calcareous districts; Europe, and, in North America, from Newfoundland to New Jersey and westward to the Mississippi. Fairly common in our region.

Allegheny : Laschell Hollow, June 15, 1902. J. A. S.
Beaver : Beaver Falls, May 14, 1907. O. E. J.
McKean : Bennett, May 19, 1895, and August 8, 1897. D. A. B.
Westmoreland : Shades, Blackburn, June 13, 1908. O. E. J. (Figured).

2. **Hygroamblystegium tenax** (Hedwig) New Combination.
(*H. irriguum* Loeske; *Hypnum irriguum* Wilson; *Amblystegium irriguum* Bryologia Europæa; *Hypnum tenax* Hedwig).
(Plate XXXIX)

Dark green, aquatic, cespitose: stems rigid, irregularly pinnate, long, denuded at the base, usually with a few paraphyllia at the nodes; stem-leaves ovate, about 1–1.5 mm. long, gradually acuminate, acute or sub-acute, narrowed at the base, sub-decurrent, spreading and sub-secund, or on the longer branches erect-spreading, entire to sub-serrulate, plane-margined; branch-leaves narrower and tending to lance-ovate; costa thick and wide, yellowish-brown, narrowing and becoming indistinct in the acumen but often reaching the apex; leaf-cells hexagonal-rhomboid, about 3–6:1, incrassate, often subopaque, smaller in the apex, at the base one or two rows usually somewhat enlarged, rectangular, incrassate, often colored, a few rows above these shorter, quadrate, but no distinct auricles being formed: seta about 1.5 cm. long, smooth, castaneous, dextrorse; capsule oblong, the urn 2–2.5 mm. long, subcernuous and sub-arcuate before ripening to strongly arcuate when dry, smooth, constricted below the mouth, brownish; annulus 3-seriate; lid convex-conic, apiculate; peristome-teeth basally confluent, orange-pellucid and dorsally cross-striolate below, bordered, strongly trabeculate; the segments slightly shorter than the teeth, carinately split but scarcely gaping, yellowish-hyaline, the 3 cilia nodose, hyaline-papillose, about as long as the segments, the basal membrane about two-fifths as high; exothecial cells small and rounded, hexagonal to trans-

versely rounded at rim but soon becoming rather elongate oblong-hexagonal or rectangular below; spores mature in late spring or early summer, brownish, medium-walled, papillose, .016–.019 mm.

On stones and earth in wet situations or in water, usually in non-calcareous districts; Europe, Asia, northern Africa, and, in North America, from Ontario to Missouri and North Carolina. Common in our region.

Allegheny : MoonTownship, May 18, 1902. J. A. S.; on rock in stream, Fern Hollow, Pittsburgh, August 22, 1906, and March 8, 1908, Darlington Hollow, October 25, 1908. O. E. J.

Bedford : In creek at base of Wills Mt., Hyndman. October 10, 1904. O. E. J.

Cambria : Cresson and Johnstown. T. P. James. (Porter's Catalogue).

Fayette : Sugar-Loaf Mt., September 1-3, 1906. O. E. J. and G. K. J.; Ohio Pyle, four miles up Meadow Run, May 30-31, 1908. O. E. J.

Huntingdon : T. C. Porter. (Porter's Catalogue).

Washington : Hanlin, May 21, 1908. O. E. J.

Westmoreland: Hillside, May 23, 1908. O. E. J. (Figured).

2*a*. **Hygroamblystegium tenax** variety **spinifolium** (Schimper) New Combination..

(*H. fallax* var. *spinifolium* Warnstorf; *Amblystegium irriguum* var. *spinifolium* Schimper; *A. fallax* var. *spinifolium* Limpricht).

This variety differs from the species in being more robust, with longer stems, longer and narrower leaves, the leaves reaching nearly 2 mm. in length and with a strongly excurrent and stout costa: Grout states the upper leaf-cells to be about 6–8:1, and the basal cells more lax.

Usually in and around calcareous springs and probably distributed mainly as is the species.

Crawford : Pymatuning Swamp, Linesville, May 12, 1908. O. E. J.

3. **Hygroamblystegium filicinum** [Linnæus] Loeske.

(*Amblystegium filicinum* DeNotaris; *Stereodon filicinus* Mitten; *Hypnum compressum* Bridel).

Variable, forming loose to dense tufts, rather rigid, bright or golden yellow: stems usually densely brownish tomentose, especially on the prostrate or procumbent forms, rather regularly pinnately branched, with usually numerous oval to lanceolate, laciniate paraphyllia; branches slender, short, stiff, non-

radiculose, with few or no paraphyllia, usually hooked at the apex; stem-leaves cordate-triangular, finely and gradually acuminate, varying from erect-spreading to sub-secund; branch-leaves rather narrower, more usually strongly falcate-secund; all leaves rigid, altered but little in drying, not plicate, markedly decurrent, the base cordate and narrowed, the margin plane or recurved at the base and closely and finely serrulate from base to apex; costa strong, usually ending in the apex; median leaf-cells elliptic-hexagonal to elongate rectangular, mostly about 3–6:1, usually obtuse at the ends, the alar abruptly inflated, hyaline or colored, forming well-defined auricles of sub-rectangular cells, these cells reaching to the base of the costa or nearly so; perichætial leaves erect, strongly costate but scarcely plicate, denticulate: seta long, flexuous, up to 3–5 cm. long, flattened and twisted; capsule sub-cylindric, rather turgid, arcuate, when dry and empty constricted below the mouth and more or less sulcate; lid conic, acute, or apiculate; peristome hypnoid, the segments more or less cleft carinately, cilia 2 or 3, nearly as long as the segments and teeth; annulus simple, narrow; spores mature in spring.

On earth, stones, etc., in or near springs, streams, or swamps, principally in calcareous districts; Europe, Asia, northern Africa, and, in North America, from the Arctic regions south to the northern United States. Rare in our region.

Huntingdon : Spruce Creek. T. C. Porter. (Porter's Catalogue).

5. *SCIAROMIUM* Mitten.

Mostly dioicous: more or less robust, stiff, cespitose, dull, dark green to blackish: stem long, floating, sparsely radiculose, with irregularly and sometimes rather fasciculately arranged branches mostly directed forwards and mostly long and simple; leaves close, spreading to secund, concave-carinate, non-plicate, not at all or but slightly decurrent, ovate to lance-oblong, subacute to acuminate, plane-margined, mostly entire, broadly and thickly bordered; costa strong, ending apically in the border or excurrent; median leaf-cells chlorophyllose, strongly incrassate, rather opaque, prosenchymatous-hexagonal, 2–4(–6):1, the basal cells more lax, the alar somewhat differentiated, the marginal slender, strongly incrassate, hyaline, in several layers; costa ending in the border at the apex: seta 1–3 cm. long, castaneous below, more yellowish above; capsule inclined, unsymmetric, oblong, when dry somewhat constricted below the mouth, annulate; peristome-teeth yellow, bordered, cross-striate, apically pale and papillose, the margin step-like, trabeculæ numerous; inner peristome yellowish, with high basal membrane, segments keeled, narrowly carinately split, cilia 1–3,

shorter than the segments and nodose; lid high-convex, apiculate; spores small.

A genus mainly confined to South America and embracing about 18 species; only 1 species occurs in North America and this occurs rarely in our region.

1. **Sciaromium lescurii** (Sullivant) Brotherus.

(*Hypnum lescurii* Sullivant; *Amblystegium lescurii* Jaeger).

(Plate XXXIX)

Loosely cespitose, dull, dark green to blackish-green: stems closely and unequally branched, the branches as described for the genus, but often with short branchlets, 1–1.5 cm. long, more or less erect, and pinnately disposed; leaves of the stem thick, rather opaque, erect-spreading, entire below to sub-serrulate all around, broadly ovate-cordate to oblong-ovate, 1–1.3 mm. long, abruptly short-acuminate, the branch-leaves similar but more lance-ovate; leaf-cells prosenchymatous, hexagonal to oblong, about 3–6:1, not much differentiated except for the yellowish or castaneous border which is composed of 4 or 5 rows of linear, prosenchymatous, flexuous, highly incrassate cells, the border cells in the alar region becoming short and rectangular or obliquely quadrilateral; costa very strong, castaneous or yellowish, merging at apex into the border: seta 1–3 cm. long, reddish; capsule short-necked, the urn about 2.5 mm. long, oblong, cernuous, somewhat arcuate; the teeth confluent at base, hyaline-papillose above, yellowish below, dorsally lamellate and cross-striate, numerously trabeculate, hyaline-margined; segments yellowish, carinately split and about as long as the teeth, the basal membrane about two-fifths as high; cilia 3 (or 4), pale, papillose, nearly as long as segments; annulus compound; spores mature in late spring or early summer, castaneous, medium-walled, smoothish, about .012–.015 mm.

On stones and rocks in streams, usually in mountainous or hilly regions; occurring from New England to Ontario and Georgia. Rare in our region.

Fayette : Ohio Pyle, May 30-31, 1908. O. E. J. (Figured).

6. *DREPANOCLADUS* (C. Mueller) Roth.

Dioicous, rarely autoicous: mostly robust, often densely cespitose, green to yellowish or brownish, lustrous: stem procumbent to erect, often floating, variously pinnate, the ends of the shoots usually circinate; leaves usually more or less circinate-secund, rarely erect to squarrose, more or less concave, from a mostly narrowed and decurrent base ovate- to triangular- or cordate-lanceolate, acute to prolonged acuminate, entire or serrulate; costa mostly simple and thin, ending usually

about the middle of the leaf, sometimes strong and percurrent or even excurrent; leaf-cells mostly long-linear, smooth, in the more or less excavate angles parenchymatous, thin-walled and hyaline or thick-walled and colored, usually forming a well-defined group sometimes reaching to the costa; inner perichætial erect, mostly plicate, elongate-subulate: seta long to very long; capsule inclined to horizontal, cylindric, arcuate, when dry constricted below the mouth, smooth, annulate; lid convex, apiculate.

A genus of over 40 species of water-mosses, quite largely swamp-mosses,—often forming quite large masses of vegetation,—almost exclusively confined to temperate and cold regions; about 22 species occur in North America, perhaps the following four to be included in our list.

Key to the Species.

a. Stem in cross-section displaying cortical layer of enlarged hyaline cells. 1. *D. uncinatus.*
a Stem without such a layer. b.
b. Leaves usually entire, the ends of stems and branches not or but slightly hooked. 2. *D. kneiffii.*
b. Leaves serrulate, ends of stems and branches hooked. c.
c. Costa usually less than three-fourths length of leaf; alar group of cells not reaching over to the costa. 3. *D. fluitans.*
c. Costa extending well up to the apex of leaf; alar group of cells large, excavate, and extending over to the costa. 4. *D. exannulatus.*

1. **Drepanocladus uncinatus** [Hedwig] Warnstorf.

(*Hypnum uncinatum* Hedwig; *Amblystegium aduncum* Lindberg; *Hypnum aduncum* Linnæus).

Rather slender and loosely interlaced, pale green or golden green: stems distantly and irregularly pinnately branched, 2–10 cm. long, in cross-section showing a layer of large hyaline cortical cells; leaves rather crowded, regularly falcate to subcircinate, little altered when dry, spirally flexuose at the points in the younger and softer branches, narrowly elongate-lanceolate, strongly plicate both wet and dry, gradually very long and slenderly acuminate, usually denticulate above, texture very thin; costa narrow, about .030–.035 mm. at base, extending well into the acumen; leaf-cells very long, linear-flexuous, thin-walled, pointed, uniform to the base and apex, the alar forming a rather small and indistinct group of slightly enlarged and slightly inflated cells, and extending decurrently below and marginally a short distance above; perichætial leaves erect, straight, long, plicate, sheathing: seta variable, but usually 2–3 cm. high; capsule cylindric, arcuate, orange-red, darker when old, when dry and empty somewhat constricted below

the mouth, smooth; annulus broad, 3-seriate; lid high-convex, conic-acuminate; peristome hypnoid, teeth orange-yellow below, paler above, segments somewhat carinately split, cilia 2, slender and about as long as segments; spores mature in late spring or early summer.

On earth, decaying wood, stones, etc., bordering streams or in wet situations in the shade, mainly in hilly or mountainous regions almost the world over; in North America from Arctic regions south to the Gulf States. Not common in our region.

Cambria : T. P. James. (Porter's Catalogue).
Huntingdon : T. C. Porter. (Porter's Catalogue).

2. **Drepanocladus kneiffii** (Schimper) Warnstorf.

(*Hypnum aduncum* var. *kneiffii* Schimper; *Amblystegium kneiffii* Bryologia Europæa).

Stems slender, long, flexuous, prostrate or ascending, more or less pinnately branched, the cross-section showing a central strand, but not a distinct cortical layer of enlarged hyaline cells; leaves distant, narrowly lanceolate, costate to the middle at least, not secund, not falcate except sometimes at the end of the branches, the acumen flat and entire, the upper leaves usually shorter and wider; basal leaf-cells much as in *D. uncinatus,* the alar somewhat larger and more inflated and extending to the costa. Closely related on the whole to *D. uncinatus,* and by some bryologists regarded as merely a variety of that species.

Along streams and ditches, about as widely distributed as the preceding species but not yet reported from our region.

3. **Drepanocladus fluitans** [Linnæus] Warnstorf.

(*Hypnum fluitans* Linnæus; *Amblystegium fluitans* DeNotaris).

Loosely and softly cespitose, yellowish to dark brown, irregularly to regularly pinnately branched: leaves more or less secund or falcate, narrowly lanceolate to oblong-lanceolate, tapering gradually into a very slender flexuose acumination, the branch-leaves somewhat narrower than the stem-leaves but quite similar, all denticulate, excavate at the base, sometimes reaching a length of 4 mm., decurrent; costa not markedly wide, reaching into the apex or at least nearly so; leaf-cells about 20–30:1, long, reaching to .100 mm. or more, pointed, narrow, somewhat incrassate, the alar enlarged, hyaline or colored and forming more or less distinct auricles reaching sometimes to the base of the costa, somewhat inflated: seta long, up to 5 or 6 cm. or sometimes much longer, flexuous, strongly dextrorse; capsule more or less inclined, curved, rather thin-walled, with a distinct collum, about 3–4:1; lid high-convex, bluntly apicualte; peristome-teeth rather short, segments

rarely carinately split, cilia usually 1 or 2, usually considerably shorter than the segments; annulus none; spores mature in summer. Very variable and split up into many forms and varieties by various authors.

In ditches, swamps, bogs, stagnant pools, etc., often immersed or floating, almost cosmopolitan in temperate and cold regions; in North America, throughout Canada and the northern United States. Rare in our region.

Center : Bear Meadows. T. C. Porter. (Porter's Catalogue).

McKean : West Branch Swamp, Bradford, in stagnant pools among willows, June 9, 1895. P. A. B.

4. **Drepanocladus exannulatus** (Guembel) Warnstorf.

(*Hypnum exannulatum* Bryologia Europæa; *Amblystegium exannulatus* DeNotaris).

(Plate XL)

Typically more rigid, compact, and more completely pinnate than *D. fluitans,* the leaves more falcate, usually serrulate, frequently striate, especially when dry: the costa reaching well towards the apex and rather stronger than in *D. fluitans,* biconvex; the alar cells hyaline and much enlarged, forming an excavate and well defined patch extending across to the costa. In our region the specimens show the following characteristics: yellowish-brown, floating, the stems up to 8 or 10 cm. long, the tips of stems and branches hooked; leaves rather remote, reaching 4 mm. long, irregularly and widely spreading, not definitely circinate or secund, except at the tips of stems and branches, slenderly acuminate into a sub-channeled acumen, entire, the base rounded to somewhat excavate and decurrent auricles, so that the insertion is more or less of a semi-circle; median leaf-cells linear, rather incrassate, about 10–15:1, reaching 0.3 mm. or even longer, towards the base rapidly becoming shorter and quickly passing into large, hyaline, oblong, much-inflated cells, thus forming a distinct patch reaching to the costa and, below, passing abruptly into the narrowly linear epidermal cells of the stem; in cross-section the stem may be seen to have the 3 or 4 outer layers small and very thick-walled.

In bogs and wet places, usually in cool or alpine regions; northern and temperate Europe and Asia and, in North America, from Greenland to Alaska south to the northern United States. Only once found in our region.

Crawford : In pools, Pymatuning Swamp, Linesville, August 19, 1904. Sterile. O. E. J. (Figured).

7. *CALLIERGON* (Sullivant) Kindberg.

Mostly dioicous: more or less robust, stiffly and loosely cespitose, greenish to brownish or yellowish, rather lustrous; stem long, in water and in deep swamps not bearing rhizoids but assuming a more or less erect habit, in dry places procumbent and bearing rhizoids, irregularly to regularly pinnately branched; stem-leaves large, erect-spreading to imbricate, concave, rarely somewhat plicate, ovate to oblong or almost circular, the apex broadly rounded to cucullate, the margin plane and entire or rarely somewhat revolute below; costa mostly strong and almost complete, sometimes indistinctly forked at the end; leaf-cells elongate, linear-hexagonal, shorter below, the alar forming a distinct group of large, quadrate, rectangular, and polygonal cells, at first thin and hyaline but later colored and incrassate, the alar portion of the leaf excavate; branch-leaves smaller, narrower, the apex often canaliculate; the inner perichætial leaves erect, more or less long-acuminate, mostly non-plicate, with a simple costa: seta mostly very long, drying flat, red to castaneous; capsule inclined to horizontal, thickly oblong to oblong-cylindric, more or less dorsally gibbous, drying arcuate, smooth; annulus none to broad; peristome normally hypnoid; lid convex, acute to obtuse-conic.

A genus of about 10 species of aquatic, largely swamp-inhabiting mosses, confined to temperate and cold regions: 8 species occurring in North America; 1 species within our range and 2 others to be expected.

Key to the Species.

a. Costa extending to the middle or a little above. (*C. stramineum* (Dickson) Kindberg).

a. Costa sub-percurrent. b.

b. Slender, simple or sparingly branched; alar cells gradually enlarged. 1. *C. cordifolium.*

b. Robust, profusely branched; alar cells abruptly enlarged. (*C. giganteum* (Schimper) Kindberg).

1. **Calliergon cordifolium** [Hedwig] Kindberg.

(*Hypnum cordifolium* Hedwig; *Amblystegium cordifolium* De Notaris).

(Plate XL)

Slender, tall, loosely and softly cespitose, green: stems brownish, 10–20 cm. in length; when growing in swamps, more or less erect; when in dryer situations, more procumbent, and furnished with rhizoids; sparsely branched, the branches more or less pinnately branched or simple, cuspidate at the tips; leaves distant, erect-spreading to spreading, thin, shrinking when dry, large, 2–5 mm. long, concave, cordate- to oblong-

ovate, entire, the apex rounded and sometimes cucullate, the base decurrent; costa slender, reaching nearly to the apex; median leaf-cells large, about .075–.125×.007–.009 mm., linear to sub-hexagonal-linear, pointed, thin-walled, the apical and upper marginal short and wide, the cells towards the base gradually becoming large, wide and more or less hyaline-inflated, rounded-hexagonal to rectangular, forming a wide but not distinctly bounded group or band reaching clear across the base of the leaf and quite strongly decurrent; perichætial leaves erect, sheathing, from an ovate base long-acuminate, up to 2.5–3 mm. long: seta erect, flexuous, usually 4–5 cm. long, castaneous, when dry flattened and dextrorse; capsule oblong-cylindric, about 3 mm. long, rather turgid-arcuate, inclined to horizontal, castaneous, slightly constricted below the mouth when dry, exannulate; peristome-teeth pale yellow, rather thin, rather long, hyaline-margined, strongly trabeculate, the dorsal lamellæ hyaline and papillose above, the basal portion rather irregularly striate, the teeth confluent at base; the segments entire or but slightly carinately split, about as long as the teeth; cilia 2 or 3, slender, nodose, about as long as the segments; the basal membrane about one-half as high as the teeth; exothecial cells incrassate, rounded-quadrate to rounded-hexagonal; lid conic, acute to apiculate; spores mature in late spring or early summer, about .012–.015 mm., yellowish, smooth, rather thin-walled.

In swamps, margins of pools, marshy places, etc.; Europe, Asia, and in North America from the Arctic region south to the northern United States. Common in the northern part of our region.

Allegheny : Brush Creek Swamp, near Douthett, June 5, 1909. O. E. J.

Cambria : Springy place on mountain-top near Lloydsville, July 22, 1908. O. E. J.

Crawford : Pymatuning Swamp, near Linesville, May 18, 1905, (Figured). O. E. J.; in Sphagnum bog near Hartstown, May 29-31, 1909. O. E. J. and G. K. J.

Erie : Damp border of lagoon at roots of bushes, Presque Isle, June 8-9, 1906. O. E. J.

McKean : Hedgehog Hollow, Bradford, April 19, 1895. West Branch Swamp, in stagnant pools, May 26, 1895, and Bennett Brook, on stones bordering stream, July 31, 1896. D. A. B.

Westmoreland : In cool mountain stream near top of Laurel Hill Mountain, New Florence, September 8-11, 1907. O. E. J.

8. *ACROCLADIUM* Mitten.

Autoicous or dioicous: robust, rather stiffly but loosely cespitose, lustrous, green to yellowish or brownish; stems long, densely foliate, the apex of the shoots rigid and acuminate by reason of the convolute apical leaves, the stems erect, not bearing rhizoids, and rather regularly complanately pinnate, or procumbent, here and there with fascicles of rhizoids, irregularly branched; leaves appressed, smooth, drying somewhat imbricate, when damp erect-spreading, concave, from a narrow and sub-decurrent base broadly oblong-ovate, obtuse, rarely apiculate, entire, the margin apically more or less involute; costa double, short, or none; leaf-cells narrowly vermicular, smooth, wider and porose towards the base, in the excavate alar portions lax, oval-4–6-sided, hyaline, thin-walled, forming a distinct auricular group; inner perichætial leaves erect, entire: seta 3–7 cm. high, twisted, reddish; capsule horizontal from an erect collum, oblong to cylindric, drying arcuate and dorsally gibbous, smooth or plicate, little narrowed below the mouth; peristome normally hypnoid with appendiculate cilia; lid convex-conic.

As here recognized the genus consists of 3 species; two in the Southern Hemisphere and the following:

1. **Acrocladium cuspidatum** [Linnæus] Lindberg.

(*Hypnum cuspidatum* Linnæus; *H. flexile* Bridel; *Calliergon cuspidatum* Kindberg).

(Plate XL)

Tall and moderately robust with characters mainly as outlined for the genus: leaves usually bright, glossy, yellowish-green, or almost pure green, broadly elliptic-oblong, up to 2.5 mm. long, concave-cucullate, entire, the apex often apiculate, ecostate or the costa short and double, leaves crowded, usually more or less erect-spreading when moist, towards the tips of the stems and branches imbricate-convolute so as to make the tips cuspidate; median leaf-cells linear-vermicular, about 10–15:1, the alar suddenly inflated, thin-walled, hexagonal, hyaline or colored, forming a very distinct group, the apical rather abruptly shorter, rounded, and incrassate: seta 4–6 cm. long; capsule reddish-brown; peristome-teeth orange, hyaline-bordered, the margins step-like above; cilia 3, appendiculate, slightly shorter than the narrowly cleft segments; spores mature in summer, the large capsules being but rarely produced; annulus 3-seriate.

In marshy places, swamps, and bogs; Europe, Asia, northern Africa, and, in North America, through Canada and the northern part of the United States. Rather uncommon in our region.

McKean : East Branch, Teina Swamp, north of Bradford, January 18, 1895. D. A. B.

Snyder : In bog between Shamokin Dam and Richfield, July 17, 1908. O. E. J. (Figured).

9. *HYGROHYPNUM* Lindberg.

Autoicous or dioicous: slender to robust, in flattish or cushion-like tufts, lustrous, green to yellowish-green or golden-green: stem long, procumbent, with few or no rhizoids, remotely and irregularly branched; leaves spreading to secund or imbricate, concave, smooth to weakly plicate, more or less decurrent, lance-ovate, and acuminate or broadly oval and obtuse to rounded, sometimes almost orbicular, margins plane, entire or serrate; costa mostly unequally forked, short, weak, rarely simple and long; leaf-cells to the base uniformly narrowly linear-vermicular, mostly with obtuse ends, smooth, the apical often shorter and rhombic, the basal yellow to orange, the alar portions little or not excavate but with wider, quadrate to rectangular, hyaline to colored cells forming a small but often well-defined auricular group; inner perichætial leaves erect, elongate, plicate, costa simple or forked, short: seta long, reddish, drying flattened and twisted; capsule inclined to horizontal, mostly oval to oblong, dorsally gibbous, drying arcuate and mostly constricted below the mouth, annulate; peristome normally hypnoid; lid convex-conic.

A genus of about 20 species in wet or moist places in cool regions; in North America about 12 species; in our region at least 2 species, probably another to be expected.

Key to the Species.

a.	Leaves falcate.	1. *H. luridum.*
a.	Leaves not falcate.	b.
b.	Costa very short, double, or forked, or none.	2. *H. eugyrium.*
b.	Costa reaching middle of leaf.	(*H. ochraceum* (Turner)Brotherus).

1. **Hygrohypnum luridum** [Hedwig] New Combination. (*Hypnum palustre* Hudson; *Amblystegium palustre* Lindberg; *Hypnum luridum* Hedwig; *Calliergon palustre* Kindberg).

Yellowish-green, or dark-green, irregularly cespitose in low patches: stems denuded below, long, divided irregularly, the branches erect to ascending, often more or less hooked at the tip; leaves close, either imbricated or more or less falcate-secund, always concave, the margins incurved towards the summit, oval- to ovate-oblong, entire, about 1–1.5 mm. long, the apex variable, either obtuse or acute or rounded and apiculate; costa usually single or forked and reaching about half way up the leaf, but variable; leaf-cells rather lax, about 5–10:1, usually linear-rhomboid, rather opaque, somewhat

shorter towards the apex and towards the base, the alar few, quadrate, sub-opaque, somewhat inflated, forming small, ill-defined auricles which are somewhat decurrent: seta about 1–2 cm. long; capsule oblong or oval-oblong, orange-brown, arcuate, rather short and thick, more or less horizontal, dark when dry, exannulate; lid orange-yellow; peristome normally hypnoid, teeth yellowish, segments scarcely carinately cleft, a little longer than the 2 or 3 cilia; spores mature in summer.

On wet rocks, where often overflowed, especially in calcareous districts; Europe, Asia, and the northern United States and Canada. Rare in our region.

Huntingdon : T. C. Porter. (Porter's Catalogue).
McKean : D. A. B. (Porter's Catalogue).

2. **Hygrohypnum eugyrium** (Bryologia Europæa) Brotherus.

(*Hypnum eugyrium* Bryologia Europæa; *Amblystegium eugyrium* Lindberg; *Calliergon eugyrium* Kindberg).

Widely cespitose in low, dense, usually sand-filled tufts, lustrous, green to reddish to brownish: stems prostrate, often leafless below; branches numerous, erect or procumbent, usually from 0.5–1.0 cm. long; leaves wide-spreading when moist, distinctly falcate-secund towards ends of branches, when dry imbricate-erect and concave, thus giving the branches a turgid appearance, oval-oblong, narrowed to the base, slightly denticulate towards the shortly acuminate acute apex, the margins incurved towards the apex; costa short, indistinct and double; median leaf-cells linear, somewhat incrassate, often somewhat obtuse at ends, about 8–10:1, shorter at the apex, the alar much enlarged and inflated, the marginal thin-walled, the inner ones incrassate, hyaline to yellowish-brown, forming well-defined and somewhat inflated auricles; perichætial leaves whitish, the outer with flexuous spreading tips, the inner erect, long-acuminate, often erose-denticulate at the apex, plicate: capsule short, oval to oblong, cernuous, turgid, yellowish-brown; peristome-teeth yellowish, slender, strongly trabeculate; segments carinately cleft and about equalled in length by the 2 or 3 granulose and nodose cilia; annulus usually 3-seriate; spores mature in spring.

On rocks in streams or along the banks where kept wet, in hilly or mountainous and usually non-calcareous regions; Europe, and from Newfoundland to Alaska and south to Georgia and Colorado. In our region apparently represented only by the following variety:

2*a*. **Hygrohypnum eugyrium** variety **mackayi** (Schimper) Brotherus.

(*Hypnum eugyrium* var. *mackayi* Schimper; *Hygrohypnum mackayi* Loeske; *Hypnum mackayi* Breidler).

(Plate XLI)

Leaves about 1–1.5×0.6–0.7 mm., broadly oblong, distinctly serrulate at apex, sub-clasping and auriculate at base, less strongly falcate than in the species; perichætial leaves hyaline, plicate, the inner reaching 3 mm. in length: seta about 2 cm. long, castaneous, smooth, somewhat flexuous, dextrorse above; capsule with urn 2–2.5 mm. long; exothecial cells rounded-hexagonal, somewhat incrassate-collenchymatous, rather uniformly seriate; peristome-teeth about as long as the slender carinate segments, the basal membrane about two-fifths as high; spores minutely papillose, rather thin-walled, faintly yellowish, about .024–.027 mm., mature in late spring or early summer.

On stones in streams in hilly or mountainous regions and with about the same general distribution as the species. Rare in our region.

McKean : On stones in brook at head of Bennett Brook, Bradford, August 26, 1894, November 2, 1896, and July, 1897. (Figured), the latter issued as Grout's North American Musci Pleurocarpi. No. 129. Also Limestone Creek, Bradford, July 7, 1895. All D. A. B.

3. **Hygrohypnum ochraceum** (Turner) Brotherus.

(*Hypnum ochraceum* Turner; *Amblystegium ochraceum* Lindberg; *Limnobium ochraceum* Bryologia Europæa).

(Plate XLI)

Yellowish or rusty green, softly cespitose in wide tufts: stems up to 8 or 9 cm. long, ascending or horizontally floating, sparsely and irregularly pinnately branched, without rhizoids, the stems and branches somewhat hooked at the apex, the cortical cells of the stem very large and relatively thin-walled; leaves falcate-secund, concave, plicate, widely lance-oblong, somewhat rounded at the base, the margins plane, entire excepting for slight serration at the rather widely sub-obtuse apex; costa single or double, often reaching half the length of the leaf; median leaf-cells linear-vermicular, about 8–14:1, fairly thick-walled, usually rounded at the ends, the apical oval-rhomboid and much shorter, the basal larger and towards the angles of the leaf forming distinct auricles of enlarged, hyaline, inflated, rectangular cells: perichætial leaves ecostate, lance-

acuminate: seta slender, flexuous, erect; capsules sub-erect to cernuous from a short erect collum, oblong, arcuate; lid convex, mamillate; peristome hypnoid, the teeth yellowish, broadly margined, rather distantly trabeculate, equalled in length by the carinately split segments, the cilia shorter, unequal, nodose, two or three in number; annulus large, usually 3-seriate; spores mature in spring or early summer.

On rocks in streams in the mountains of northern and temperate Europe and Asia and, in North America, from the Arctic regions south to the northern United States. Although rare in this district, so far as now known, this species may eventually be found to be not uncommon in cool, rocky streams in the more mountainous parts of our region.

Westmoreland: In mountain rivulet, Mellon's estate, Laurel Hill Mt., New Florence, September 8-10, 1907. O. E. J. Sterile. (Figured).

10. *CAMPYLIUM* (Sullivant) Bryhn.

Mostly dioicous: slender, rarely robust, mostly stiffly cespitose, green to yellowish or brownish, drying more or less lustrous; stems creeping to ascending or erect, bushy to variously pinnate; leaves from a shortly decurrent base broadly ovate or cordate, gradually or abruptly narrowed into a long, slender, canaliculate acumination which is mostly strongly squarrose-reflexed, margin plane, mostly entire; costa various, mostly short; cells narrowly rectangular-oblong to linear-prosenchymatous, smooth; alar cells forming a distinct group, yellowish, incrassate, small, quadrate: seta long, drying twisted, reddish to yellowish-red; capsule inclined to horizontal, sub-cylindric, arcuate, annulate; peristome normally hypnoid; lid convex, acute to conic-obtuse; spores small.

About 33 species in both dry and wet habitats, mainly confined to the temperate regions; about 20 species in North America; 4 species in our region.

Key to the Species.

a. Costa simple, thin, ending in about the middle of the leaf, or somewhat above the middle. c.

a. Costa none or very short. b.

b. Stem slender, creeping; leaves finely serrulate all around; alar cells small, quadrate. 1. *C. hispidulum.*

b. Stem usually erect; leaves entire; alar cells dilated, sub-rectangular. 4. *C. stellatum.*

c. Leaves strongly squarrose; alar cells scarcely enlarged. 2. *C. chrysophyllum.*

c. Leaves spreading-erect; alar cells enlarged. 3. *C. polygamum.*

1. **Campylium hispidulum** (Bridel) Mitten.

(*Hypnum hispidulum* Bridel; *Chrysohypnum hispidulum* Roth; *Stereodon hispidulus* Mitten; *Amblystegium hispidulum* Kindberg).

(Plate XLI)

Slender, interlaced in bright green tufts more or less yellowish below; stems creeping, radiculose, abundantly but irregularly branching, the branchlets slender and erect or ascending; leaves widely spreading to distinctly squarrose, about 0.5–0.8 mm. long, triangular-cordate, abruptly acuminate, the slender acumen about one-third to one-half as long as the main body of the leaf, the leaf slightly concave, decurrent, sub-serrulate all around, excavate at the base; costa double and very short, or none; median leaf-cells about 3–6:1, about .005–.006 mm. wide, prosenchymatous, elongate-oblong with blunt ends, the alar numerous, sub-rectangular to quadrate, granulose, up to twice as wide as the median cells: seta pale castaneous to yellow, about 1.5 cm. long, slender dextrorse; capsule small, oblong, more or less incurved, yellowish-brown, wide-mouthed, the urn about 1.2–1.4 mm. long, when dry furrowed and narrowed below the mouth; annulus uni-seriate; lid convex-conic with an upturned apiculation; peristome normally hypnoid, the segments slightly cleft and almost equalled in length by the nodose to sub-appendiculate cilia; spores mature in summer, yellowish, medium-walled, minutely papillose, about .011–.014 mm.

On the bases and roots of trees, on decaying wood, on humus, etc., always near the ground in moist shaded places; in Europe, Asia, and, in North America, from North Carolina and Missouri to Canada. Common in our region.

Allegheny	: Moon Township, April, 1902. J. A. S.; Coraopolis, September 4, 1905. O. E. J. and G. E. K.
Cambria	: T. P. James. (Porter's Catalogue).
Center	: Edge of pond at Scotia, September 20, 1909. O. E. J. (Figured).
Erie	: Presque Isle, June 9-11, 1905. O. E. J.
Indiana	: T. P. James. (Porter's Catalogue).
Fayette	: Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.
McKean	: Quintuple Ridge, November 26, 1896, Bolivar Run, December 15, 1896, September 24, 1896, Langmade Hollow, all near Bradford. D. A. B.

Washington : Linn and Simonton. (Porter's Catalogue); on log on shaded hillside, three miles southwest of Library, April 22, 1906. O. E. J.

2. **Campylium chrysophyllum** (Bridel) Bryhn.

(*Hypnum chrysophyllum* Bridel; *Chrysohypnum chrysophyllum* Loeske; *Amblystegium chrysophyllum* DeNotaris).

(Plate XLI)

Cespitose in low, lax, or dense, bright golden-green tufts: stems slender, rather long, prostrate, more or less regularly pinnate, the branchlets erect or spreading; leaves close, small, 1–1.5×0.4–0.7 mm., squarrose-spreading from a sub-clasping base, sometimes secund, stem-leaves ovate-cordate to triangular-cordate, decurrent, narrowed abruptly to a long somewhat channeled acumination, entire or very slightly denticulate at base; branch-leaves similar but smaller and narrower; costa single, reaching about to the middle or higher; median leaf-cells about 5–10:1, about .005–.010 mm. wide, rather incrassate, the alar forming a group of small, incrassate, subopaque, sub-quadrate cells: seta castaneous, about 2-2.5 cm. long, slender, flexuous; capsule oblong-cylindric, inclined to horizontal, arcuate, castaneous to orange; annulus large, compound; peristome normally hypnoid, the teeth yellowish, hyaline-margined, strongly trabeculate, dorsally lamellate, cross-striolate below, hyaline and papillose above; the segments not usually carinately split, the cilia stout, nodose, 2 or 3, and about as long as segments, basal membrane one-half as high as segments; spores in early summer, light brown, smooth, .010–.012 mm.: dioicous.

On earth, stones, roots of trees, etc., in moist places; Europe, Asia, and, in North America, from Canada to Louisiana. Common in our region.

Allegheny : Laschell Hollow, June 15, 1902. J. A. S.; Schenley Park, Pittsburgh, August 20, 1905, Power's Run, June 17, 1909, Guyasuta Hollow, October 25, 1908. O. E. J.

Beaver : Beaver Falls, May 14, 1907. O. E. J.

Crawford : Pymatuning Swamp, Linesville, May 10-11, 1906, and May 12, 1908. O. E. J. (Figured).

Fayette : Ohio Pyle, May 13, 1905, May 30-31, 1908. O. E. J.; Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.

Westmoreland : Hillside, May 23, 1908. O. E. J.

McKean : Langmade, April 28, 1897, and Marilla Brook, August 28, 1898, near Bradford. D. A. B.

3. **Campylium polygamum** (Schimper) Bryhn. (*Hypnum polygamum* Wilson; *Chrysohypnum polygamum* Loeske).

(Plate XLII)

Moderately robust, yellowish-green to golden, low, cespitose: stems erect to ascending, about 3–6 cm. long, divided and with rather numerous, irregularly pinnate, rather crowded, and erect or ascending branchlets; stem-leaves lance-ovate, 2–2.5 mm. long, moderately close, erect-spreading both wet and dry, with an ovate or oblong base narrowed above into a long, gradually tapering, channeled acumination, entire, the base rounded and clasping, somewhat decurrent; branch-leaves elongate-lanceolate, with the sides tapering in a straight line from the rounded-ovate base, the leaves averaging about 3 mm. long; median leaf-cells narrowly linear, about 8–12:1, in the older leaves somewhat incrassate, towards the base often porose, the alar sub-rectangular, somewhat enlarged, distinct, forming often orange-pellucid auricles; costa not very strong but distinct and usually reaching somewhat above the middle of the leaf: seta slender, flexuous, about 3–4 cm. long; capsule oblong-cylindric, curved; peristome normally hypnoid, cilia well developed; annulus present; spores mature in summer.

In moist places in meadows and swamps and said to prefer sandy soils; Europe, Asia, and from Arctic North America to the northern United States. Rare in our region.

Allegheny : Schenley Park, Pittsburgh, August 26, 1906. O. E. J. (?).

Crawford : Near Linesville in the Pymatuning Swamp, May 10-11, 1906. O. E. J. (Figured).

4. **Campylium stellatum** [Schreber] Lange and C. Jensen. (*Hypnum stellatum* Schreber; *Chrysohypnum stellatum* Loeske; *Amblystegium stellatum* Lindberg).

(Plate XLII)

Robust, densely tufted, soft, lustrous, bright to golden green: stems stout, usually ascending, up to 8 or 10 cm. long, irregularly divided, the branchlets sub-pinnate and more or less crowded and erect; leaves close, from 1–3 mm. long, from an erect-spreading and more or less cordate base narrowed, often rather abruptly, to a gradually long-acuminate, acute, squarrosely spreading acumen, the base entire or sometimes slightly denticulate, slightly excavate and with rounded and sub-decurrent auricles, the upper part of the leaf more or less channeled; costa very short, either single, forked, or double, but usually appearing only as yellowish or brownish striæ; median leaf-cells narrowly linear, about 8–15:1, in the older

leaves rather incrassate and blunt at the ends, the basal often porose, the alar sub-rectangular, incrassate, rather opaque, usually more or less orange-pellucid, forming distinct, often somewhat decurrent auricles: seta rather long, castaneous, up to 4.5 cm. long, stout, dextrorse above, flexuous; capsule oblong-cylindric, about 3–4.5:1, arcuate, the urn 2–2.5 mm. long, inclined to horizontal, sulcate and constricted below the mouth when dry and empty, brownish; lid highly convex-acuminate; annulus 2–3-seriate; peristome normally hypnoid, large, the teeth trabeculate, confluent at base, the lower part orange-colored and dorsally cross-striolate, the lamellæ and divisural distinct, the upper part paler and papillose; segments somewhat shorter and slightly carinately split; cilia 2 (or 3), nodose, about as long as the segments; spores mature in summer, minutely papillose, rather thin-walled, pale yellowish, .011–.014 mm.

On wet banks in swamps; Europe, Asia, and from Arctic America southwards to Virginia. Rare in our region.

Erie : Presque Isle, May 8-9, 1906. O. E. J. (Figured).

McKean : D. A. B. (Porter's Catalogue).

11. *CTENIDIUM* (Schimper) Mitten.

Usually dioicous, mostly slender, soft, cespitose, green to yellowish or golden-brown, lustrous: stem long, here and there with clusters of rhizoids, more or less regularly pinnate, branches short and mostly horizontally spreading; leaves spreading or circinate-secund, decurrent, non-plicate to weakly plicate, mostly abruptly lance-subulate from a broadly cordate base, serrate (*C. procerrimum* is entire); costa double and very short or none; cells narrowly linear, the upper angle usually ending in a forward-projecting papilla, the alar cells distinct, quadrate and rectangular, the angles sometimes weakly excavate; branch-leaves smaller: seta 1–2.5 cm. long, red, smooth or nearly so; capsule inclined to nearly horizontal, thickly oval, dorsally gibbous, not constricted below the mouth; annulus broad, revoluble; peristome normally hypnoid; lid long-conic, acute or obtuse; calyptra mostly more or less hairy.

A genus of 21 species occurring mainly on trees and rocks in temperate and warm regions; 4 species in North America, the following species in our range:

1. **Ctenidium molluscum** [Hedwig] Mitten.

(*Hypnum molluscum* Hedwig; *H. compressum* Roth).

(Plate XLII)

Very densely cespitose, soft, lustrous, golden-green, rather robust: stems reaching 10 cm. in length, prostrate or ascend-

ing, closely regularly pinnate, plumose; leaves densely imbricated, falcate-secund to circinate, stem-leaves 1.8–2.5 mm. long, when dry usually plicate, and, especially towards the points, more or less undulate and crisped, from a cordate-triangular, concave, and auriculate base rather abruptly and slenderly long-acuminate, plane-margined, strongly serrate, especially at the base, somewhat decurrent; costa very short and double or none; median leaf-cells about 8–15:1, the corners somewhat projecting dorsally, gradually towards the angles becoming irregularly quadrate-hexagonal, shorter and wider, pellucid, forming poorly defined auricles of about the same color as the rest of the leaf; branch-leaves considerably smaller and narrower, not cordate-auriculate; perichætial leaves slenderly lance-acuminate; paraphyllia ovate, mostly at the base of the branches: seta brownish, flexuous, slender, about 1.0–2.5 cm. long, castaneous; capsule-urn about 2.5 mm. long, oblong to oval, slightly curved to almost straight, from the curved apex of the seta mostly horizontal, not constricted below the mouth when dry; lid conic-acuminate; annulus broad; peristome normally hypnoid, teeth yellowish, segments carinately cleft, about as long as teeth, the cilia 2 or 3, stout, about as long as the segments, the basal membrane about one-half the height of the peristome; calyptra somewhat hairy when young; spores mature in summer, smooth, yellowish-incrassate, about .015–.018 mm.

On moist, shaded earth and rocks in woods in hilly or mountainous districts; Europe, Asia, northern Africa, and from Newfoundland to the Rocky Mountains and south to Georgia. Rather common in our region.

Blair	: A. P. Garber. (Porter's Catalogue).
Cambria	: Cresson. T. C. Porter. (Porter's Catalogue).
Elk	: McMinn. (Porter's Catalogue).
McKean	: On rich, shaded bank of stream, Langmade, April 3, 1897, and April 25, 1897. (Figured), and on rocks bordering rivulets, head of Gates' Hollow, Bradford, October 27, 1895. D. A. B.
Washington	: Linn and Simonton. (Porter's Catalogue).

12. *RHYTIDIADELPHUS* (Lindberg) Warnstorf.

Dioicous: more or, less robust, stiff, loosely cespitose forming loose, wide, stiff, green to yellowish or grayish, and rather lustrous mats; stem angled, long, without rhizoids, simple to regularly or irregularly pinnate; branches partly short and obtuse, partly long and acuminate, and often curved above; upper half of the leaf spreading-squarrose to reflexed-

squarrose, sometimes circinate-secund, mostly plicate, scarcely decurrent, from an ovate or cordate base more or less long-acuminate, plane-margined, rather sharply serrate; costa short, double, or sometimes none; cells narrowly linear, smooth, or the upper angle projecting dorsally as a tooth, the basal wider, shorter, more or less incrassate and porose, colored, the alar mostly not differentiated; seta 2–4 cm. long, castaneous; capsule horizontal to pendent, from a very short neck thickly oval, dorsally gibbous, when dry and empty plicate, but not constricted below the mouth, annulate; peristome normally hypnoid; lid convex, conic-acute.

A genus of 5 species of forest and meadow in the temperate and cold regions of the Northern Hemisphere; 4 species in North America; 2 species in our region.

Key to the Species.

a. Cells smooth both sides; stem-leaves not plicate, squarrose-recurved. 1. *R. squarrosus.*

a Cells dorsally spinose; stem-leaves strongly plicate, spreading. 2. *R. triquetrus.*

1. **Rhytidiadelphus squarrosus** [Linnæus] Warnstorf.

(*Hypnum squarrosum* Linnæus; *Hylocomium squarrosum* Bryologia Europæa).

Widely and softly cespitose, bright green, lustrous: stems robust, but slender, up to 10 or even 15 cm. long, procumbent or more or less ascending to erect at the ends, the branchlets rather distant, flexuous, unequal, attenuated and more or less sub-flagelliform; stem-leaves crowded, about 3 mm. long, abruptly squarrose from a cordate-ovate more or less erect-sheathing base, not secund, imbricated, the squarrose portion long and gradually tapering and channeled, denticulate above, the apical leaves somewhat stellately spreading, branch-leaves smaller but otherwise very similar to stem-leaves; costa short, double, faint; median leaf-cells smooth dorsally, about 8–10:1, narrowly-linear, the alar gradually rectangular-hexagonal, larger, short, opaque to pellucid, numerous, but not forming abruptly differentiated auricles; perichætial leaves squarrose, the inner linear-acuminate and apically serrate: seta usually 3–4 cm. long, flexuous; capsule short, ovoid, dorsally gibbous, inclined to horizontal, or even pendent by the curving of the upper part of the seta; lid convex-conic, rather acute; annulus 2-seriate; peristome normally hypnoid, segments carinately split between the articulations, cilia 3; spores mature in winter or early spring.

In moist or wet meadows and borders of woods in grassy places; Azores, Europe, Asia, and, in North America, from the Arctic regions to the northern United States. Rare in our region.

Cambria : Lesquereux, at Cresson. (Porter's Flora).

2. **Rhytidiadelphus triquetrus** [Linnæus] Warnstorf.

(*Hypnum triquetrum* Linnæus; *Hylocomium triquetrum* Bryologia Europæa).

(Plate XLIII)

Robust, stiff, bright to yellowish-green, bushy-cespitose: stems long, up to 15 or 18 cm., branching unequally and irregularly, sometimes more or less pinnately, reddish, woody, ascending or sometimes erect; stem-leaves large, 4–5 mm. long, stiff, scarious, divaricately or horizontally spreading both wet and dry, widely cordate- to deltoid-triangular, widely rounded-auriculate at base, the insertion narrow and decurrent; leaves plicate, denticulate, papillose dorsally, gradually tapering above to a sub-acute apex; branch-leaves narrower and smaller towards the ends of the attenuate branches; costa forked, or of two parallel divisions reaching about three-fourths the length of the leaf; perichætial leaves non-costate, the acuminations squarrose; median leaf-cells linear, about 8–10:1, at the angles oblong-hexagonal, pellucid, not usually forming distinct auricles, the upper cells dorsally forming spinulose papillæ: seta 1.5–2.5 cm. long, rather rigid, lustrous, castaneous; capsule turgid-oblong, large, castaneous, about 3 mm. long, dorsally gibbous, inclined or more nearly horizontal by a curve in the upper part of the seta, when dry more or less plicate and constricted below the mouth; the exothecial cells rounded-hexagonal, rather small, incrassate, castaneous; lid conic, acute; peristome normally hypnoid, the teeth orange-yellow, strongly trabeculate, dorsally lamellate, the lamellæ papillose but non-striate, projecting to form a distinct border; the segments carinately split, the cilia 2 (or 3) and about as long as the segments, stout, the basal membrane reaching about one-half the height of the peristome; spores medium-walled, smooth, yellowish, .018–.025 mm.

On shaded banks in woods with a moderate amount of moisture, or in swamps; Europe, Asia, northern Africa, and, in North America from the Arctic regions south to the northern United States, and along the mountains in North Carolina. Not uncommon in our region.

Cambria	: T. C. Porter. (Porter's Catalogue).
Elk	: McMinn. (Porter's Catalogue).
McKean	: On decaying leaves under hemlocks, Marilla Brook, Bradford, June 5, 1895 (Figured), and September 29, 1894; Bennett Brook, July 15, 1893. D. A. B.
Washington	: Linn and Simonton. (Porter's Catalogue).

13. *RHYTIDIUM* (Sullivant) Kindberg.

Dioicous: very robust, in wide, loose, yellowish or brownish-yellow tufts: when dry stiff and lustrous; stems long, tumid,

with hooked tips, prostrate to ascending or erect, with few or no rhizoids, simple to regularly pinnate, rarely bushy; branches 2-seriate, short and thick, or longer, acuminate and downwardly arcuate; leaves crowded, imbricate, falcate-secund, concave, plicate, rugose, scarcely decurrent, oval to oblong-ovate, narrowed into a long, canaliculate, lance-subulate, sharply-toothed point, the margin more or less revolute; costa simple, thin, sometimes reaching to mid-leaf; median leaf-cells narrowly vermicular, with dorsally (sometimes a few ventrally, also) projecting and forward-pointing teeth-like papillæ at the upper end of the cell, towards the costa at base the cells more lax, rectangular, porose, incrassate, the alar region not excavate, the alar cells forming a distinct longitudinal band of small, quadrate and polygonal, yellowish, incrassate, numerous cells; inner perichætial leaves elongate-lanceolate, slenderly acuminate, plicate, serrate, ecostate: seta 2–5 cm. long, castaneous, when dry twisted; capsule inclined to horizontal, elliptic to sub-cylindric, dorsally gibbous, when dry arcuate and constricted below the mouth, brownish; annulus 3-seriate, remaining attached to the operculum; lid convex-conic, shortly and obliquely rostrate; peristome normally hypnoid, teeth rusty-yellow, segments broadly split, cilia 2, as long as the segments; spores in summer but capsules very rarely produced.

One species, as follows, on exposed sunny rocks and ledges, and in dry, grassy places; Europe, Asia, and from Arctic America through Canada to the northern United States. Usually in hilly or mountainous regions on calcareous substrata. Rare in our region.

1. **Rhytidium rugosum** [Ehrhart] Kindberg.

(*Hylocomium rugosum* DeNotaris; *Hypnum rugosum* Ehrhart).

Stems reaching 8 or 10 cm. or more, the branches tumid and sometimes 4–6 mm. in diameter; the leaves 3 mm. long or more, sometimes costate above the middle, margins narrowly reflexed.

Huntingdon : T. C. Porter. (Porter's Catalogue).

14. *HYLOCOMIUM* Bryologia Europæa.

Dioicous, more or less robust, stiffly and laxly cespitose in green or yellowish and more or less lustrous tufts: stem mostly very long and procumbent or ascending, more or less arcuate, once to three times pinnate; paraphyllia numerous, much-branched; leaves more or less spreading, concave, mostly plicate, oblong to cordate, long-acuminate, plane-margined, serrate; costa thin, double, sometimes reaching mid-leaf; cells linear, mostly smooth, basally shorter and laxer, colored, incrassate, porose, alar not differentiated; inner perichætial

leaves with reflexed-squarrose acuminations: seta more or less elongate, red; capsule inclined to horizontal, thickly ovate or oblong-oval, somewhat dorsally gibbous, with neck short and narrowed into the seta, drying mostly smooth and scarcely constricted below the mouth, annulate; peristome normally hypnoid; lid convex with a conic-acute point or shortly and obliquely rostrate.

A genus of 6 species, mainly mosses of forests in temperate and cold regions; 6 species occurring in North America; 3 species in our region.

Key to the Species.

a. Leaves at base semi-amplexicaul, with very large and rounded auricles. 3. *H. brevirostre.*

a. Leaves with broad insertion but not with rounded auricles. b.

b. Stem closely 2–3 pinnate; leaves obscurely bi-costate. 1. *H. splendens.*

b. Stem irregularly or distantly 1–2 pinnate; costa double and reaching to about mid-leaf. 2. *H. umbratum.*

1. **Hylocomium splendens** (Hedwig) Bryologia Europæa. (*Hypnum splendens* Hedwig; *Hylocomium proliferum* Lindberg).

(Plate XLIII)

Widely cespitose in loose mats, lustrous, yellowish to brownish or olive-green: stems long, trailing, red, with green, branched paraphyllia, stems sometimes up to 15 or 20 cm. long, divided, the fern-like shoot of each year ascending from the side of the upper third of the preceding year's shoot, the divisions usually complanately and loosely bi- to tri-pinnate; stem-leaves crowded, erect-spreading to loosely imbricate, broadly ovate to ovate-oblong, 2–3 mm. long, the insertion wide, the upper portion of the leaf abruptly acuminate into a slender, transversely undulate and flexuous point, or sometimes shorter and obtuse, the leaves basally plicate, sub-decurrent, somewhat concave, recurved at margin below, denticulate and dorsally spinulosely papillose above; branch-leaves usually acute, smaller and non-plicate, concave, elliptic-oblong; costa double and reaching to one-fourth or one-third the length of the leaf, but faint; median leaf-cells linear-flexuous, about 8–10:1, the lower more or less porose, the basal orange-pellucid, incrassate and larger, but not forming distinct auricular groups; perichætial bracts long, the inner erect, narrowly acuminate and sheathing: seta about 1.5–2.0 cm. long, red, usually stiff, curved, when dry wrinkled and sometimes sinistrorse; capsule oblong-ovate, orange-brown, somewhat turgid, usually horizontally inclined, the urn about 2 mm. long; peristome hypnoid, the teeth basally confluent, trabeculate, lamellate, dorsally striolate below, papillose above, brownish; seg-

ments about as long, widely carinately gaping, yellowish, the three slender, nodose cilia about as long, the basal membrane about two-fifths as high as the teeth; lid rostrate; exothecial cells brownish, rather thin-walled, rectangular to hexagonal, several rows at the rim much smaller; spores smooth, medium-walled, .010–.014 mm., mature in spring.

On stones and logs in rich and moist mountain woods; Europe, Asia, northern Africa, and in North America from the Arctic regions south to the northern United States. Not uncommon in our region.

Blair	: T. C. Porter. (Porter's Catalogue).
Elk	: McMinn. (Porter's Catalogue).
Jefferson	: Kate Stoy.
McKean	: On logs and on ground over leaves, Rutherford Run, April 25, 1893, West Branch Swamp, on logs, October 15, 1893, and on rich, shaded bank over leaves, Marilla Brook, June 30, 1895. (Figured), all Bradford. D. A. B.
Washington	: Linn and Simonton. (Porter's Catalogue).

2. **Hylocomium umbratum** [Ehrhart] Bryologia Europæa.

(*Hypnum umbratum* Ehrhart).

(Plate XLIV)

Slender, not so large and not complanately branched as in *H. splendens*, more erect and forming loose, green tufts often 12 or 15 cm. high, sometimes yellowish, somewhat lustrous: stems rigid, pinnately or bi-pinnately branched, the branchlets unequal, often drooping, sometimes distinctly flagelliform, the stems reddish, bearing numerous conspicuous and branched paraphyllia; stem-leaves quite broadly triangular-ovate, rather distant, rather spreading, about 2 mm. long, acute to long-acuminate, decurrent, strongly plicate, undulately strongly dentate all around, the teeth sometimes recurved, no papillæ on back of leaf; branch-leaves more ovate and smaller; costa double and strong, reaching to about mid-leaf; median leaf-cells about 8–10:1, linear, not forming distinct auricles, the extreme basal castaneous-incrassate, rounded; perichætial leaves broad, apically spreading: seta slender, 3–4 cm. long, flexuous; capsule short, about 2:1, turgid-ovate, more or less horizontally inclined, somewhat plicate and constricted below the mouth when dry and empty; peristome normally hypnoid, segments carinately split, the cilia usually 2, about as long as segments; annulus none; lid conic, shortly apiculate; spores mature in early spring.

Over rocks, logs, and woods-humus, in mountain woods; Europe, Asia, and, in North America, from Newfoundland to

Alaska south to the northern United States, and southwards in the mountains. Rare in our region.

McKean : In deep, densely shaded ravines, altitude 1700 feet, along Marilla Brook, one-half mile above Bradford, April 21, 1897. D. A. B. (Figured).

3. **Hylocomium brevirostre** [Ehrhart] Bryologia Europæa. (*Hypnum brevirostre* Ehrhart; *H. interruptum* Bridel).

(Plate XLIV)

Robust, rigid, forming large, swollen tufts of a dark but glossy yellow-green: stems much-divided, up to 12–15 cm. long, erect to arched-procumbent, irregularly pinnately branched, the branches unequal, attenuate, not complanately arranged, but bushy, paraphyllia rather small, branched, stems reddish-brown; stem-leaves somewhat crowded, spreading to squarrose, about 2–4 mm. long, cordate-ovate to triangular-ovate, abruptly narrowed to a rather long channeled acumen, the base notably with large rounded, sub-clasping, and somewhat decurrent auricles, the margins finely and regularly denticulate, the leaves when dry much plicate; branch-leaves smaller, narrower, more ovate, less squarrose; perichætial leaves sheathing at base, subulate-acuminate, squarrose, apically serrate; costa of stem- and branch-leaves double and reaching to about one-third the length of the leaf: seta flexuous, about 2 cm. long, dextrorse and arcuate above, castaneous; capsule turgidly ovate-oblong, horizontally inclined, the urn about 2 mm. long, castaneous, arcuate and constricted below the mouth when dry; lid conic-acuminate, about 1 mm. long; annulus usually 2-seriate, rather wide; peristome hypnoid, teeth orange-yellow, dorsally lamellate, cross-striolate below, papillose above, moderately trabeculate, confluent and inserted at base; segments slender, about as long as teeth, yellowish, carinately gaping, finely spinose-papillose above, the basal membrane about two-fifths as high; cilia usually 2, short, nodose-appendiculate; exothecial cells laterally strongly castaneous-incrassate, rounded-hexagonal to rounded-rectangular; spores about .021–.024 mm., oblong to round, castaneous, moderately incrassate, somewhat papillose, mature in early spring.

In deep, shaded ravines and in swamps on rocks and at the bases of trees, usually confined to mountainous regions; Europe, Asia, northern Africa, and, in North America, from Nova Scotia to Ontario and south in the mountains to North Carolina. Rather common in our region.

Blair : T. C. Porter. (Porter's Catalogue).
Cambria : T. P. James. (Porter's Catalogue).

Clinton : Between Renovo and Haneyville, July 15, 1908. O. E. J.
Elk : McMinn. (Porter's Catalogue).
McKean : In thin mats on perpendicular face of sandstone rocks at head of Rutherford Run, altitude 1800-2000 feet, April 25, 1895, and on densely shaded rocks along Marilla Brook, one-half mile above reservoir, Bradford. D. A. B. The latter issued as Grout's No. 44*a*, North American Musci Pleurocarpi. (Figured).
Washington : Linn and Simonton. (Porter's Catalogue).

15. *HYPNUM* Linnæus, Hedwig.

Dioicous: robust, stiff, deeply and loosely cespitose, dark to pale green or almost straw-colored, more or less lustrous: from a decumbent base ascending to erect, with straight pointed ends and rather regularly pinnate; branches mostly spreading and 2-seriate, usually slenderly attenuate, sometimes thick and obtuse; no paraphyllia; leaves crowded, imbricately appressed, spoon-shaped, more or less distinctly plicate, scarcely decurrent, broadly ovate to ovate-oblong, apex blunt, the margin often narrowly revolute below and broadly involute upwards, at the very apex only weakly crenulate or serrulate; costa indistinct, or very thin, short and double; median leaf-cells narrowly prosenchymatous, smooth, the basal shorter, laxer, porose, incrassate, yellowsih to orange-red, the alar abruptly enlarged, quadrate to shortly rectangular, or several-angled, incrassate, colored, the alæ more or less excavate; perichætial leaves sheathing, lance-oblong, rather abruptly acuminate, indistinctly costate: seta 2–4 cm. long, sinistrorse, tortuous, yellowish-red to red; capsule cernuous, 2–2.5 mm. long, usually horizontal, symmetric, or dorsally somewhat gibbous, drying arcuate, slightly constricted below the mouth, brownish, smooth; annulus none; lid high-convex, acute or conic-obtuse.

The genus as here restricted contains only the following species:

1. **Hypnum schreberi** Willdenow, Schwaegrichen.

(*H. parietinum* Linnæus; *H. muticum* Swartz; *Stereodon schreberi* Mitten; *Hylocomium parietinum* Lindberg).

(Plate XLIV)

Usually bright yellowish-green: stems up to 12 or 15 cm. long, bright red; stem-leaves 1.5–2.5 mm. long; median leaf-cells about 10–15:1, the apical shorter: capsules produced rather infrequently; exothecial cells transversely oblong-hexagonal, laterally strongly castaneous-incrassate; peristome-

teeth slender, strongly trabeculate, dorsally lamellate, faintly transversely papillose-striolate, margined, yellowish, confluent below; segments broad, nearly as long as the teeth, widely carinately gaping, yellowish and papillose; cilia sub-appendiculate, about as long as the segments, usually single; the basal membrane about two-fifths as high as teeth; spores about .014–.018 mm., smooth, moderately incrassate, castaneous.

Mainly over humus, etc., in moist, shaded woods, but occurring in moist pastures, dry open woods, and bogs as well; Europe, Asia, and from Arctic America to the northern United States. Not uncommon in the northern and central parts of Pennsylvania.

Elk	: McMinn. (Porter's Catalogue).
Huntingdon	: T. C. Porter. (Porter's Catalogue).
McKean	: Rutherford Rocks, on perpendicular face of moist sandstone in wide mats, altitude of 2000 feet, April 25, 1893; on decaying log, West Branch Swamp, April 5, 1895, and Bradley Run (Figured), all near Bradford. D. A. B.
Somerset	: Allegheny Mountains, August 17, 1875. B. H. Patterson.
Cameron	: On ground in pine grove, Hunt's Run, April 29, 1893. D. A. B.

16. *PTILIUM* (Sullivant) DeNotaris.

Dioicous: robust, stiff, laxly cespitose, plume-like, yellowish-green, in shade bright green, lustrous; stem 5–20 cm. long, ascending to erect, simple or 2–3-divided, regularly and densely complanately pinnate with dense complanate branches; branches horizontally spreading, circinate at the apex, of nearly equal length below, rapidly becoming shorter at the apex; leaves crowded, circinate to almost coiled, deeply pluri-plicate, long-lance-subulate from a broadly ovate and scarcely decurrent base, plane-margined, finely serrulate above the middle; costa none, or double and short; median leaf-cells very narrowly linear, vermicular-prosenchymatous, smooth, the basal shorter, wider often and porose, a few alar indistinctly differentiated, quadrate to shortly rectangular: seta 3–5 cm. long, tortuous, red, drying dextrorse above; capsule cernuous to horizontal, arcuate, about 2 mm. long, castaneous, cylindric, smooth; annulus narrow, 2-seriate; lid dome-like, shortly apiculate.

The genus contains only 1 species, as follows:

1. **Ptilium crista-castrensis** [Linnæus] DeNotaris.
(*Hypnum crista-castrensis* Linnæus; *Stereodon crista-castrensis* Mitten).

(Plate XLV)

An easily recognized, rigid, robust, plume-like, bright yellowish-green species: stem-leaves about 2–3 mm. long; median leaf-cells about 10–20:1; branch-leaves not usually reaching 2 mm. in length; exothecial cells strongly castaneous-incrassate, small and rounded in several series at the rim, below becoming oblong-rectangular; peristome-teeth castaneous, large, strongly trabeculate, lamellate, crosswise faintly and finely dorsally papillose-striolate, confluent below; segments as long as teeth, yellowish, papillose; the basal membrane about one-half as high; cilia 2–4, slender, hyaline, about as long as the segments, nodose-appendiculate; spores smoothish, castaneous, medium-walled, about .010–.014 mm., usually mature in early autumn.

On woods-humus, rotten logs, and moist earth, in woods, usually in mountainous regions; Europe, Asia, and from Arctic America south to the northern United States and southwards in the mountains to North Carolina. Not uncommon in the more mountainous portions of our region.

Cambria	: Cresson. T. C. Porter. (Porter's Catalogue).
Blair	: A. P. Garber. (Porter's Catalogue).
Clinton	: Deep mountain woods above Renovo, July, 1908. O. E. J.
Elk	: McMinn. (Porter's Catalogue).
Fayette	: Forming a thick mat on rock in deep wooded ravine four miles south of Ohio Pyle, September, 1-3, 1906. O. E. J. and G. K. J.
McKean	: D. A. Burnett. (Porter's Catalogue).
Somerset	: Allegheny Mountains, August 17, 1875. B. H. Patterson. (Figured).
Washington	: Linn and Simonton. (Porter's Catalogue).

17. *STEREODON* Bridel, Mitten.

Mainly dioicous: robust to quite slender, green to yellowish-green or golden-brown, lustrous: stems elongate, decumbent or ascending, rarely erect, mostly non-stoloniferous, simple or divided, irregularly or rarely regularly pinnate, the shoots mostly with hooked or circinate ends; leaves 2-seriate, falcate-secund, non-decurrent or but slightly so, rather concave, ovate- to cordate-lanceolate, acuminate to more or less subulate-acuminate; costa short and double or none; leaf-cells narrowly prosenchymatous, smooth on both sides, the basal most-

ly incrassate and porose, parenchymatous in the mostly somewhat excavate angles; inner perichætial leaves plicate, lance-subulate: seta long, drying twisted; capsule cernuous to horizontal, rarely erect, oblong to cylindric, arcuate or rarely straight, mostly smooth and annulate; lid convex-conic, umbonate to apiculate or sometimes short-rostrate.

A genus of about 115 species, mainly confined to the temperate regions; at least 40 species occur in North America; about 11 species in our region.

Key to the Species.

a. Leaves not falcate nor secund. b.
a. Leaves falcate or secund. c.
b. Leaves entire. 8. *S. haldanianus.*
b. Leaves distinctly serrulate, at least towards the apex. (*S. nemorous* (Koch) Lindberg).
c. Leaves usually distinctly entire. d.
c. Leaves serrulate, at least towards the apex. f.
d. Distinctly regularly pinnate. 6. *S. arcuatus.*
d. Not distinctly regularly pinnate. e.
e. Perichætial leaves plicate; alar leaf-cells strongly inflated. 7. *S. pratensis.*
e. Perichætial leaves not plicate; alar leaf-cells not strongly inflated. 4. *S. cupressiformis.*
f. With alar cells strongly inflated. i.
f. With alar cells not strongly inflated. g.
g. Stems not regularly pinnate; leaves usually entire. 4. *S. cupressiformis.*
g. Stems regularly pinnate; leaves serrulate, at least above. h.
h. Alar leaf-cells not inflated: capsule strongly arcuate. 1. *S. reptilis.*
h. A few alar leaf-cells somewhat inflated: capsule more or less symmetric. 3. *S. imponens.*
i. More or less regularly and evenly pinnate. k.
i. Not regularly pinnate. j
j. Lid altogether about as long as the urn. 9. *S. recurvans.*
j. Lid altogether about one-half as long as the urn. 10. *S. delicatulus.*
k. Slender and sparsely branched: lid altogether about one-half as long as the urn; cilia rudimentary or none. 11. *S. tenuirostris.*
k. More robust and more abundantly branching: lid relatively short; cilia well developed. l.
l. Capsule when dry and empty smooth to sub-costate; spores about .015–.018 mm. 2. *S. fertilis.*
l. Capsule when dry and empty strongly plicate; spores about .019–.023 mm. 5. *S. curvifolius.*

1. **Stereodon reptilis** (Richard) Mitten.

(*Hypnum reptilis* Richard).

(Plate XLV)

Small, dark or yellowish-green, lustrous, widely and loosely cespitose: stems more or less regularly pinnate but not

closely interwoven; stem-leaves crowded, lance-acuminate from an ovate-oblong base, about 1×0.4–0.5 mm., falcate-secund, slightly decurrent, serrate above, serrulate below, the margins usually revolute; median leaf-cells linear-rhomboidal to linear-flexuous, about 8–12:1, shorter and more or less colored towards the base, the alar cells quadrate, much incrassate, subopaque; branch-leaves similar but proportionally much narrower; paraphyllia small and few; costa double, short, yellowish, or none; inner perichætial leaves long-acuminate, usually faintly bi-costate, apically serrate, strongly plicate: seta castaneous, lustrous, about 1.5 cm. long, when dry dextrorse above; capsules about 2.5 mm. long, cylindric, yellowish, mostly abruptly arcuate just below the mouth so that the lid often points at right angles to the direction assumed by the base of the capsule, when dry the urn more or less wrinkled and narrowed below the mouth; lid yellow, rather large, high-convex, narrowly obliquely rostrate; peristome hypnoid, the teeth subulate-acuminate, orange-yellow and dorsally cross-striolate at base, hyaline and papillose above; segments about as long as teeth, carinately cleft between the articulations; cilia usually 2, articulate, slightly shorter than the segments; annulus large, compound; spores rather strongly incrassate, yellowish-brown, papillose, about .014–.017 mm., mature in midsummer.

On bases of trees, roots, logs, etc., in woods, especially in spruce woods and mainly confined to hilly or mountainous regions; Europe, Asia, and from Canada south in the mountains to North Carolina and in the West to Utah. Rare in our region.

McKean : Gates' Hollow, March 10, 1894, and July 25, 1895, Marilla Brook, July 5, 1896, Latshaw, August 25, 1895, and Bennett, August 8, 1897. (Figured). All near Bradford. D. A. B.

2. **Stereodon fertilis** (Sendtner) Lindberg.

(*Hypnum fertile* Sendtner).

(Plate XLV)

Yellowish-green, lustrous, usually darker below, densely interwoven: stems prostrate or ascending, from 3–10 cm. long, scarcely branching, castaneous, densely and rather regularly, complanately and somewhat plumosely pinnate with short branchlets; stem-leaves 1.5–2.0 mm. long, concave, falcate-secund, scarcely complanate, from an oblong-ovate base slenderly acuminate, the base sub-decurrent, sub-auriculate, somewhat excavate, the margin plane, entire below, serrulate above; costa usually bi-furcate or double, rarely none; branch-leaves

similar to stem-leaves but smaller and narrower, strongly falcate to circinate-secund; inner perichætial leaves lance-acuminate, plicate, faintly bi-costate, serrulate above; median leaf-cells linear-vermicular, about 1:15–20, rather incrassate, sub-acute, median basal cells strongly incrassate, castaneous-pellucid, porose, the alar portion with several oblong inflated hyaline cells, above which is a patch of about 9–15 smaller, incrassate, quadrate to oblong-hexagonal cells often more or less castaneous-pellucid: seta 1.5–2.0 cm. long, dextrorse, castaneous, lustrous; capsule about 1.8 mm. long, oblong, inclined to horizontal, arcuate, bright castaneous with a darker and lustrous rim, when dry narrowed below the mouth and sub-costate or smooth; lid short, conic-acute; peristome-teeth lance-subulate, brownish-pellucid, more or less narrowly hyaline-margined, dorsally cross-striolate below, the divisural line and the lamellæ fairly distinct, above hyaline and papillose, the trabeculæ numerous and strong; segments pale, about as long as the teeth, carinately split between the articulations, the basal membrane about two-fifths as high, the cilia usually 2, hyaline, nodose, somewhat shorter than the segments; exothecial cells rather thin-walled, quadrate-hexagonal to oblong-hexagonal, at the mouth smaller and deeply castaneous; spores medium-walled, somewhat brownish, smooth or very nearly so, about .015–.018 mm., mature in late summer.

On decaying logs in moist and cool places, usually in hilly or mountainous regions; Europe, Asia, and, in North America, from New Brunswick to British Columbia and southwards to the northern United States. Rare in our region, and probably only to be found in the northern portion.

McKean : Leer's Run on decaying log, August 5, 1895 (Figured), Langmade Hollow, August 11, 1895, Gates' Hollow, October 27, 1895, and Bennett Brook, August 8, 1897. D. A. B.

3. **Stereodon imponens** (Hedwig) Lindberg.

(*Hypnum imponens* Hedwig; *H. cupressiforme* Hooker).

(Plate XLV)

Robust in flat, thin, widely interwoven tufts of a yellow-green color: stems rigid, reddish-brown, with numerous paraphyllia, closely, rather regularly and more or less complanately pinnate, prostrate or sub-erect, sometimes reaching more than 10 cm. in length; stem-leaves usually somewhat complanate-secund, from a triangular-oblong base gradually long-acuminate, the base not excavate, scarcely decurrent, the acumen strongly falcate-secund, the whole leaf about 2×0.5–0.7 mm., serrulate above, the margin often narrowly recurved

below; branch-leaves narrower, otherwise similar to the stem-leaves, about as long; costa short and double or none; median leaf-cells linear-vermicular, about 10–15:1, the basal broader and more or less orange-pellucid, the alar cells sub-quadrate, a few somewhat inflated at the extreme angles, forming a small but quite distinct auricular patch of an orange-brown color, all cells rather incrassate; perichætial leaves plicate, ecostate, spinose-serrulate above: seta about 3 cm. long, castaneous, sinistrorse when dry; capsule cylindric, nearly erect, slightly curved, about 3–4 mm. long, castaneous, about 4–6:1; lid convex at base with an oblique long-acuminate point; peristome normally hypnoid, the teeth strongly trabeculate, the trabeculæ often dividing, the lamellæ and divisural distinct, cross-striolate below; the segments about as long, slightly carinately split, the basal membrane reaching about two-fifths as high, the cilia articulate and usually single; annulus compound, adherent; exothecial cells yellowish-pellucid, laterally quite incrassate, oblong-quadrate to long-rectangular; spores yellowish, medium-walled, minutely roughened, about .013–.015 mm., mature in late autumn or early winter.

On earth, stones, roots, logs, etc., with us mainly on humus or rotten wood, in moist woods; Europe, Asia, and from Canada southwards to California and Georgia. Very common in our region.

Allegheny	: Eighteen pockets determined, various localities, collectors, and dates. Figured from specimen from Wildwood Road Hollow, November 19, 1908. O. E. J.
Armstrong	: Kittanning, September 24, 1904. O. E. J.
Cambria	: Cresson. T. C. Porter. (Porter's Catalogue).
Crawford	: Linesville, May 10-11, 1906, and June 11-12, 1907. O. E. J.
Elk	: McMinn. (Porter's Catalogue).
Erie	: Presque Isle, May 8-9, 1906. O. E. J.
Fayette	: Twenty-six pockets determined, various dates and collectors, mainly Ohio Pyle and Cheat Haven.
McKean	: Quintuple Ridge, November 13, 1896. D. A. B.
Somerset	: Keystone, October 9, 1904. O. E. J.
Washington	: North Branch, Maple Creek, above Charleroi, April 24, 1908. O. E. J.; Linn and Simonton. (Porter's Catalogue).
Westmoreland	: Near Apollo, 1902. Miss K. R. Holmes; Mellon's estate, Laurel Hill Mts., near New Florence. O. E. J. September 8-11,

1907; "Shades," near Blackburn, March 25, 1910. O. E. J. and G. K. J.

4. **Stereodon cupressiformis** [Linnæus] Lindberg.

(*Hypnum cupressiformis* Linnæus; *H. compressum* Schultz).

Widely cespitose in flat, soft tufts, usually yellowish or brownish-green: stems up to 10 cm. long, greenish, procumbent, irregularly pinnate, the branches spreading or ascending, usually curved; leaves closely imbricate, concave at the base, slightly decurrent, falcate-secund, lustrous, oblong- to ovate-lanceolate, narrowed rather abruptly to a long acumination, plane-margined, typically entire, sometimes denticulate towards the apex; costa none or very short and double; median leaf-cells about 10–15:1, linear-vermicular, rather obtuse, the angular sub-quadrate, numerous, rather opaque. a few at the extreme angles larger, scarcely inflated, orange-pellucid, or hyaline, rather incrassate, the auricles not well-defined; perichætial leaves denticulate, not plicate: seta red, about 3–4 cm. long; capsule sub-erect, curved, sub-cylindric or oblong, cast-taneous, somewhat constricted below the mouth when dry; lid convex at base, with an acuminate apex; peristome normally hypnoid; cilia usually one or two; spores mature in late autumn or early winter.

On rocks, roots, and bases of trees, in moist woods or ravines; practically cosmopolitan,—in North America occurring from the Arctic regions to the Gulf States. Rare in our region.

Cambria : T. P. James. (Porter's Catalogue).

McKean : Three pockets so-labeled in the Carnegie Museum Herbarium are apparently typical *S. fertilis* and the Porter Catalogue record is probably founded upon some of the same Burnett collections.

4*a*. **Stereodon cupressiformis** variety **filiformis** (Bridel) New Combination.

(*Hypnum cupressiforme* var. *filiforme* Bridel).

(Plate XLVI)

More slender, distantly pinnate, the branches long, very slender and almost filiform; leaves very small, falcate-secund, more or less regularly and neatly imbricated in two rows.

Habitat and range as for the species. Rare in our region.

McKean : Rutherford Rocks, on moist and densely shaded fragments of sandstone at base of cliff, May 5, 1895, and Hawkin's Hollow, August 2, 1895. D. A. B. (Figured).

5. **Stereodon curvifolius** (Hedwig) Mitten.

(*Hypnum curvifolium* Hedwig).

(Plate XLVI)

Robust, lustrous, yellowish-green in large flat mats: stems prostrate, rather regularly pinnately branched, the branchlets short and unequal, the whole plant complanately secund; leaves crowded, imbricate in two rows, falcate-secund, thus giving to the plants a plaited appearance from the dorsal viewpoint; stem-leaves about 0.7–0.8×1.4–1.8 mm., oblong-ovate to elongate and triangular-ovate, short-acuminate, plane-margined, crenulate-serrulate about to the middle, and at the angles, concave, at the base abruptly narrowed and cordate or sub-cordate, somewhat decurrent; costa none or double and faint; branch-leaves similar but proportionally shorter and narrower, about 0.4–0.5×1–1.5 mm.; median leaf-cells about .005–.007×.035–.050 mm., linear-vermicular, basal median cells incrassate, porose, more or less vermicular to linear-oblong, a few of the alar cells sub-quadrate, yellowish or brownish and incrassate, about .020–.025 mm. in diameter, the decurrent cells enlarged, thin-walled, and hyaline; perichætial leaves erect, whitish, numerous, the inner sheathing, plicate, reaching 4–5 mm. long: seta about 2.5 cm. long, dextrorse above, sinistrorse below, castaneous, sub-lustrous; capsule about 2.5 mm. long, pale castaneous, constricted below the mouth when dry and empty and then also strongly plicate, the urn oblong, arcuate, cernuous; lid conic, apiculate; peristome normally hypnoid, teeth yellowish pellucid, slender, strongly trabeculate, the lamellæ and divisural distinct, the apical portion of the teeth hyaline and papillose, the lower dorsal surface cross-striolate; segments about as long as the teeth, slender, slightly carinately cleft, pale yellowish-pellucid, cilia two or three, about as long as segments, articulate, hyaline, papillose; annulus 3-seriate, revoluble; spores yellowish, medium-walled, granulose, about .019–.023 mm., mature in early spring.

On rocks or more usually on decaying logs in moist woods; Asia, and from Arctic America south to Florida and Colorado. Common in our region.

Armstrong	: Kittanning, on rotten log, August 16, 1905. O. E. J.
Beaver	: Beaver Falls, May 11, 1907. O. E. J.
Cambria	: Ebensberg. T. P. James. (Porter's Catalogue).
Crawford	: Linesville, Pymatuning Swamp, June 11-12, 1907, May 12, 1908 (Figured), and August 3, 1909. O. E. J.
Erie	: Presque Isle, June 8-9, 1906. O. E. J.

McKean : Bennett Brook, May 3, 1893, Langmade Hollow, May 5, 1894, Marilla Brook, Bradford, June 30, 1895. D. A. B.
Fayette : Ten different collections from Ohio Pyle, O. E. J., G. K. J. and J. A. S.
Mercer : Half-Moon Swamp, June 12, 1906. O. E. J.
Somerset : Ursina, May 12, 1905. O. E. J.
Washington : Three miles southwest of Library, April 29, 1906. O. E. J.
Westmoreland : "Shades," near Blackburn, June 13, 1908. O. E. J.; and same locality March 25, 1910. O. E. J. and G. K. J.

6. **Stereodon arcuatus** (Lindberg) Lindberg.
(*Hypnum arcuatum* Lindberg; *H. lindbergii* Mitten; *H. patientiae* Lindberg).

(Plate XLVI)

Robust, widely cespitose in yellowish-green mats, usually more or less regularly pinnate, lustrous at least on the younger parts: stems prostrate, usually sparsely branched; stem-leaves about 1.6–2.2 mm. long, complanately falcate-secund, lustrous, ovate-oblong, decurrent, the margins plane and entire or sub-denticulate at the apex, the leaves rather shortly and broadly acuminate, the tip flat and widely acute to somewhat obtuse, the decurrent auricles are made up of large, oblong, inflated, thin-walled, and hyaline cells bordered above by about two series of smaller, quadrate, usually brownish-pellucid, thicker-walled cells, these latter grading quickly into linear-vermicular median cells about 12–20:1, the apical cells oblong-rectangular or obliquely more or less rhomboidal; costa very short and double or none; branch-leaves similar; perichætial leaves sheathing, the inner lanceolate to lance-linear, up to 6 or 7 mm. long, plicate, entire, acuminate; seta about 2.5–3 cm. long, dextrorse, lustrous, castaneous; capsule about 2–2.5 mm. long, about 4–5:1, oblong-cylindric, erect at base but arcuate so that the lid usually points more or less horizontally, when dry plicate but scarcely narrowed, below the mouth; annulus large, revoluble; lid conic, apiculate, scarcely longer than wide; peristome hypnoid, the teeth lance-linear, dorsally cross-striolate, yellowish-pellucid below, hyaline and papillose above, the divisural and dorsal lamellæ prominent, the trabeculæ strong and numerous; segments rising from a basal membrane about two-fifths the height of the teeth, the segments about as long as teeth, narrow, somewhat carinately split; cilia 1–3, shorter, nodose, hyaline-papillose, often joined together above; spores smoothish, yellowish, moderately incrassate, about .014–.018 mm., mature in spring.

On the ground in woods and wet, grassy places in swamps, around springs, etc.; Europe, Asia, and from Arctic America to the northern United States and south in the east to Florida. Fairly common in our region.

Allegheny : Along Brush Creek, near Douthett, April 26, 1908. O. E. J.
Armstrong : Kittanning, May 28, 1907. O. E. J. (Figured).
Lawrence : Springy places along roadside, East Brook, August 30, 1906. O. E. J.
McKean : Bolivar, June 7, 1898. D. A. B.
Washington : Wet clay bank, Bellevernon, May 21, 1907. O. E. J.

7. **Stereodon pratensis** (Koch) Warnstorf.

(*Hypnum pratense* Koch; *Isopterygium pratense* Lindberg).

Softly and flatly cespitose, bright green, complanately flattened: stems prostrate to sub-erect, non-radiculose, irregularly sub-pinnate, branchlets rather sparse; leaves subsecund on the larger branches and on the stems, plane to somewhat concave, entire; costa double and very faint and short; median leaf-cells narrowly rhomboid-vermicular, at the angles large and inflated, usually colored, the alar enlarged, fewer, less enlarged and less differentiated than in *S. patentiae;* perichætial leaves plicate, the inner long-lanceolate and shortly acuminate: pedicel long, twisted in two directions; capsule non-plicate, oblong to turgid-ovate, cernuous, arcuate when dry; lid convex-conic; annulus 3-seriate; peristome normally hypnoid, the cilia 3, about as long as the segments; spores mature in spring. The capsules are rarely produced.

In open swamps and marshy meadows; Europe, Asia, and from Arctic America to Florida. Only once reported for our region.

Cambria : Wiltmore. T. P. James. (Porter's Catalogue).

8. **Stereodon haldanianus** (Greville) Lindberg.

(*Hypnum haldanianum* Greville; *Heterophyllon baldani* Kindberg; *Hypnum pulchrum* Hooker).

(Plate XLVI)

Widely and loosely cespitose, dark to brownish-green: stems long, creeping, irregularly pinnate, the branchlets unequal and disposed much as in some of the *Brachytheciae;* leaves loosely and more or less evenly imbricate to loosely spreading; stem-leaves usually slightly decurrent, about 0.7–1.5 mm. long, oblong-ovate to somewhat lanceolate, rapidly narrowed to a short and acute apex, entire, plane-margined, concave; branch-

leaves lance-ovate to lanceolate, about 0.5–1.5 mm. long, short-acuminate, otherwise similar to the stem-leaves; median leaf-cells linear-flexuose, about 12–20:1, prosenchymatous, the alar inflated, rather incrassate, large, forming a quite distinct auricle, bordered above by a few considerably smaller and chlorophyllose cells; costa rudimentary or none, or double and short; perichætial leaves spreading, abruptly filiform-acuminate, the inner non-plicate; paraphyllia large and numerous: seta about 2.5 cm. long, lustrous, castaneous, when dry sinistrorse; capsule long-cylindric, dull-castaneous, curved, suberect to more or less inclined, about 4–6:1, urn about 2.5–3 mm. long, the lid conic and obliquely short-rostrate; peristome-teeth confluent at base, transversely striolate and yellowish below, strongly trabeculate, the divisural and the dorsal lamellæ usually faint; segments slightly carinately cleft, below more or less faintly transversely striolate-papillose, above papillose, about as long as the teeth; cilia usually single and shorter, sometimes two and rudimentary, or sometimes none, articulate; spores granulose, yellowish-brown, somewhat incrassate, about .015–.016 mm., mature in late fall or winter.

On earth, humus, rocks, rotten logs, etc., in woods; Europe, Asia, and, in North America, from Nova Scotia to Montana and southwards to the Gulf States. Very common in our region.

Allegheny	: Thirteen pockets determined from various ravines and hollows in the county. Figured from specimens from Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J.
Armstrong	: Kittanning. D. R. Sumstine. 1904.
Butler	: Swampy woods near Crider's Corners, April 26, and December 29, 1908. O. E. J.
Cambria	: Ebensburg. T. P. James. (Porter's Catalogue).
Crawford	: Pymatuning Swamp, Linesville, May 18, 1905. O. E. J.; Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
Elk	: McMinn. (Porter's Catalogue).
Fayette	: Ohio Pyle, September 1-3, 1907. O. E. J. and G. K. J.
McKean	: Four localities near Bradford, 1894-1896. D. A. B.

9. **Stereodon recurvans** [Richard] Brotherus.

(*Hypnum recurvans* Schwaegrichen; *Sematophyllum recurvans* E. G. Britton; *Leskea recurvans* Richard; *Rhaphidostegium recurvans* Jaeger).

(Plate XLVII)

Very glossy, widely cespitose in flat tufts, usually yellowish-green: stems prostrate, reddish, irregularly branching; leaves about 1.2–1.5 mm. long, strongly complanately falcate-secund, close, imbricate at base, soft, thin, more or less concave, lance-ovate, slenderly long-acuminate, non-decurrent, more or less sharply serrate at the apex, the margin often narrowly recurved below; costa obsolete, or very short and double; perichætial leaves gradually long-acuminate, serrate at apex; median leaf-cells linear-flexuose, the basal yellowish or brownish, shorter, wider, the alar consisting of a group of 4 to 8 hyaline or colored, much inflated and enlarged cells forming a group bordered above by a few sub-quadrate and smaller cells: seta about 1.5–2 cm. long, lustrous, castaneous, somewhat sinistrorse; capsule oblong-oval, slightly curved, obliquely inclined to almost horizontal, the urn about 3–4:1, about 1.5–2 mm. long, light castaneous, the tapering base darker, the urn when old strongly arcuate; annulus present; lid conic and together with the slender beak about one-half the length of the urn; peristome hypnoid, the teeth large, strongly trabeculate, the divisural faint, the thin dorsal lamellæ transversely papillose-striolate; segments about as long as teeth but usually not splitting, the basal membrane about two-fifths as long, the cilia usually one, sometimes two, slightly appendiculate, somewhat shorter than the segments; spores .016–.018 mm., medium-walled, granulose, brownish, mature in late fall, the capsules often remaining in good condition until early spring: dioicous.

On soil, humus, bases of trees, logs, etc., in moist woods, mainly in mountainous or hilly regions; from Newfoundland to Manitoba and south to North Carolina and Missouri, also in Mexico. Very common in our region.

Allegheny	: Near Pittsburgh, August, 1905. O. E. J.
Armstrong	: Kittanning, September 24, 1904. O. E. J.
Butler	: Winfield Junction, May 26, 1906. O. E. J.
Crawford	: Linesville, May 13, 1905, and June 11-12, 1907. O. E. J.; Hartstown, May 29-31, 1909. O. E. J. and G. K. J.
Elk	: McMinn. (Porter's Catalogue).
Fayette	: Ohio Pyle, September 10, 1905, and four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.; (Figured);

Ohio Pyle, July 4, 1908, and May 30-31, 1908. O. E. J. (Figured as to old capsule and peristome.)

McKean : Bennett Brook, September 10, 1894, Gates' Hollow, October 27, 1895, and November 4, 1895, and Langmade Hollow, April 26, 1896. All near Bradford. D. A. Burnett.

Somerset : Keystone, October 9, 1904. O. E. J.

Westmoreland : Mellon's estate (Rachelwood) on Laurel Hill Mts., September 8-10, 1907, and "Shades," near Blackburn, March 25, 1910. O. E. J. and G. K. J.

10. **Stereodon delicatulus** (James) Brotherus.

(*Hypnum laxepatulum* Lesquereux and James; *Rhynchostegium delicatulum* James; *Sematophyllum delicatulum* E. G. Britton; *Rhaphidostegium delicatulum* Paris).

Small, depressed cespitose, dark green, scarcely lustrous: stems slender, prostrate, subpinnately branching; leaves rather open, falcate-secund, two-ranked, sharply serrulate towards the apex; costa none or very short and double; leaves concave, ovate, narrowed into a long acumination; a few of the extreme alar cells much enlarged and inflated as in *S. recurvans,* colored or hyaline, bordered by a few sub-quadrate and smaller, the median linear-flexuous, prosenchymatous; perichætial leaves non-plicate, sharply serrate above: seta shorter than in *S. recurvans;* capsule ovoid-oblong, curved, inclined, about 2–3:1, urn about equalled in length by the slenderly long-rostrate lid; peristome hypnoid, segments entire, cilia usually one or two; spores mature in late fall.

On rotten wood, or soil, or at the base of trees, mainly in the mountains from New England to Alabama. Rare in our region.

McKean : Bradford. D. A. Burnett. (Porter's Catalogue).

11. **Stereodon tenuirostris** (Bruch and Schimper) Brotherus.

(*Sematophyllum tenuirostre* E. G. Britton; *Hypnum cylindrocarpum* C. Mueller; *Rhaphidostegium cylindricarpum* Jaeger).

(Plate XLVII)

Flatly and broadly cespitose in thin intricate mats, slender: stems prostrate, reddish, or green, pinnately branched, branches few, slender; stem-leaves sub-lustrous, 1.5–2.5 mm. long, falcate-secund but not complanate, narrowly lance-oblong, non-decurrent, acuminate, concave, apically serrate, marginally somewhat reflexed to the base of the acumen; median leaf-cells linear-prosenchymatous, the apical usually a little larger, the alar few in number, inflated, sub-quadrate,

bordered above by a few small quadrate, sub-opaque, often transversely elongated cells; branch-leaves similar to the stem-leaves, sometimes a little larger; costa very short and double or none; perichætial leaves erect, the inner plicate and gradually narrowed to a very slender serrate point, with a very short and double costa or none: seta about 5–7 mm. long, sinistrorse above, lustrous, castaneous; capsule cylindric to lance-oblong, the urn about 1–1.5 mm. long, erect to somewhat inclined, symmetric; annulus none; exothecial cells somewhat collenchymatous, brownish, oblong-rectangular, the upper 3 or 4 rows rounded-quadrate; peristome-teeth yellowish, lance-subulate, finely cross-striolate, strongly trabeculate, the dorsal lamellæ projecting to form a rather conspicuous hyaline border; segments about three-fourths as long, slender, carinately split between the articulations, the basal membrane about one-third as high as the teeth, cilia none or very rudimentary; lid conic and with a slender oblique rostrum about one-half as long as the urn; spores in late fall to early spring, about .014–.018 mm., smoothish, brownish, rather thinly incrassate.

On rotten logs and on rocks in dark woods; Labrador and Newfoundland south, mainly in the mountains, to Georgia. Rather uncommon in our region.

Allegheny : Wildwood Road Hollow, side of ravine under dense shade of hemlocks, November 19, 1908. O. E. J.

Fayette : On rock in shaded woods in valley of Meadow Run, four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.

Westmoreland : "Shades," near Blackburn, March 25, 1910. O. E. J. and G. K. J. (Figured).

18. *ISOPTERYGIUM* Mitten.

Autoicous or dioicous: mostly slender to very slender, cespitose, soft, mostly bright or yellowish-green: stem creeping to ascending, upright only in the thick mats, mostly irregularly branched; leaves uniform, obliquely inserted, smooth, usually more or less two-seriate, from a narrow and little or not at all decurrent base oval to oblong-oval and short-pointed or else ovate to lance-oblong and acute to piliferous, margins plane and entire to serrate; costa double, very short, or none; cells prosenchymatous, smooth or papillose in the upper angle, the basal shorter, the alar not usually differentiated: seta long, smooth, mostly drying twisted; capsule sub-erect to cernuous or horizontal, with a collum, oval to oblong or cylindric, almost symmetric or weakly gibbous, when dry only rarely arcuate and narrowed below the mouth, mostly smooth;

annulus present or none; peristome-teeth basally confluent, subulate, yellowish, mostly hyaline-bordered, with divisural zigzag, cross-striate, apically hyaline and papillose, lamellæ numerous; cilia 1–2, nodose, rarely 3 and appendiculate; lid conic-convex, sometimes rostrate.

A genus of world-wide distribution and containing about 170 species, mostly occurring on decaying wood; about 25 species in North America; about 7 species in our region.

Key to the Species.

a. Leaves entire or obscurely serrulate at apex. b.
a. Leaves distinctly serrulate at least in upper half.
b. Leaves perfectly entire. c.
b. Leaves obscurely serrulate at apex. d.
c. Cells about .005–.008×.075–.160 mm., about two rows at the base shorter and sub-oval. 5. *I. pulchellum* var. *nitidulum.*
c. Cells about .003–.005×.080–.100 mm., hardly different at base. 1. *I. muellerianum.*
d. Alar cells few, quadrate, forming a small group. 6. *I. micans.*
d. Alar cells very indistinctly sub-rectangular. 2. *I. elegans.*
e. Leaves shortly bi-costate; annulus large and compound. 4. *I. geophilum.*
e. Leaves ecostate or obsoletely costate. f.
f. Leaves serrulate to the base. 3. *I. deplanatum.*
f. Leaves not serrulate below the middle. 7. *I. turfaceum.*

1. **Isopterygium muellerianum** (Schimper) Lindberg.

(*Plagiothecium muellerianum* Schimper).

Yellowish-green, laxly cespitose; the branches long, flattened, straggling out into flagella or stolons or forming flattened strands, very slender; the stems and branches thick, often more than .150 mm. in diameter, with very large and thin-walled outer cells which are 3 or 4 times as wide as the lower cells of the leaf and usually about .015–.025 mm. wide; leaves rigid, not much different when dry, the points directed forwards and upwards so that the dorsal surface of the branch is concave, lance-ovate, abruptly long-apiculate, concave, non-decurrent, plane-margined, entire; costa double, very faint and short; median cells linear, narrow, up to .100 mm. long, about 20–25:1, the alar and basal scarcely different; perichætial leaves ovate-oblong, acuminate, entire: seta rather short, castaneous; capsule smooth, small, long-necked, obovate, erect to inclined, when dry pale brown, wide-mouthed and campanulate; lid conical, rostellate; peristome-teeth with rather distant articulations, cilia short and unequal; annulus 1-seriate; spores mature in autumn; dioicous.

On moist earth and rocks in ravines, etc., mostly in hilly or mountainous regions; Europe, Asia, and from New England

to Ohio and southward in the mountains to North Carolina. Not yet reported from our region but to be expected,—especially in the more mountainous portions.

2. **Isoptergyium elegans** [Hooker] Lindberg.

(*Hypnum elegans* Hooker; *Isothecium elegans* Bridel; *Plagiothecium elegans* Sullivant).

Small, densely cespitose, thin, pale shining green: stems branching complanately, the branches slender, partly procumbent, partly ascending, numerous, usually pointing one way; usually there are also axillary, gemmiferous branchlets; leaves complanate, sub-distichous, the points usually pointing downwards, lustrous, little changed when dry, about 1–1.5 mm. long, lance-oblong to ovate-oblong, rather gradually narrowed from about the middle, then abruptly narrowed to a fine, short acumen, the base rounded, non-decurrent, plane-margined, entire except at the acumen where a little denticulate; costa double and short, faint or sometimes reaching one-third the length of the leaf; median leaf-cells narrowly linear, about 20–30:1, about .004–.007 mm., pointed, hardly differentiated at the angles; perichætial leaves lance-acuminate: capsule turgid-oval, slightly inflated at the curved neck, nearly symmetric but horizontal or sub-pendent by a curve in the upper part of the costa, when dry and empty somewhat wide-mouthed, turbinate, costate; peristome hypnoid, yellow, teeth broadly lanceolate, blunt, segments entire, cilia 3, rather slender, as long as the segments; annulus simple; lid conic, obtusely pointed; spores mature in spring.

On rocks or earth in hilly or mountainous regions in woods; Europe, Asia, and from Arctic America to northern United States and south in the mountains to Alabama. Rare in our region.

McKean : D. A. Burnett. (Porter's Catalogue).

3. **Isopterygium deplanatum** (Sullivant) Mitten.

(*Hypnum deplanatum* Sullivant; *Rhynchostegium deplanatum* Schimper).

Golden-green, lustrous, small, flattened: stems prostrate, irregularly pinnately branching; leaves 2-ranked, imbricate, thin, concave, ovate-lanceolate, gradually long-acuminate, serrulate all around, more sharply so above, plane-margined; median leaf-cells linear, flexuous, prosenchymatous, the basal somewhat larger but very similar; costa none or but very faint: oval-oblong, cernuous, arcuate, plicate when dry and then constricted below the mouth; peristome hypnoid, segments narrow, cilia 2 or 3, about as long as the segments, unequal; annulus none; spores in autumn, but capsules rarely produced.

Over earth, stones, and rotten wood and humus, in woods; from Nova Scotia to Manitoba and southward to Missouri and Maryland. Rare in our region.

McKean : D. A. Burnett. (Porter's Catalogue).

4. **Isopterygium geophilum** (Austin) Jaeger.

(*Rhynchostegium geophilum* Austin; *Plagiothecium geophilum* Grout; *Hypnum depressum* Sullivant and Lesquereux).

Dark green, very glossy, thinly, softly, and loosely matted: stems prostrate, irregularly divided, more or less compressed; leaves flat, distichous, rather distant, widely spreading, oblong-lanceolate, gradually and symmetrically narrowed to a somewhat blunt apex, serrate above, rounded at the base, non-decurrent; costa short, double, rather distinct; median leaf-cells linear, prosenchymatous, flexuous, about 8–12:1, a few alar sub-rectangular, hyaline, only a little enlarged and not forming a distinct auricle: capsule small, ovate, gibbous, thin-walled, unsymmetric, inclined; peristome normally hypnoid, teeth yellowish, segments narrow, linear, the cilia 2 or 3, some as long as segments; annulus large, 2-seriate; lid conic, obliquely long-rostrate.

On moist earth or stones, usually near water in lowlands; occurring from New York to Wisconsin and south to Maryland. Rare,—in our region reported but once.

Cambria : Cresson. T. C. Porter. (Porter's Catalogue).

5. **Isopterygium pulchellum** variety **nitidulum** (Wahlenberg) Brotherus.

(*Hypnum pulchellum* var. *nitidulum* Lesquereux and James; *H. nitidum* Weber and Mohr; *Leskea nitidula* Wahlenberg).

Slender, in prostrate and straggling tufts, bright glossy metallic green: stems creeping, usually not much more than 1 cm. long, complanately branched, the branches numerous and slender; leaves sub-distichous, about 1 mm. long, more or less falcate, very glossy, hardly altered when dry, entire, plane-margined, narrowly lance-ovate, from near the base gradually narrowed to a long and slender acumen, the base rounded but not decurrent nor excavate; costa usually none; median leaf-cells narrowly linear, about 15–25:1, .005–.008 mm. wide, pointed, the basal sub-oval and wider and shorter but not differentiated otherwise at the angles: seta reddish, slender, about 1.5–2 cm. long; capsule small, rather variable, ranging from oblong and tapering below into the neck to short and ovoid, and from erect and symmetric to curved and more or less horizontal, when dry usually wide-mouthed and constricted below the rim, ranging from greenish-brown when young to castaneous when old; lid conic, apiculate; peristome-teeth

densely barred, cilia 2, a little shorter than the segments; spores mature in early summer.—The species (*I. pulchellum*) has numerous, erect, curved branchlets with leaves not complanate but sub-falcate and regularly homomallous, and more often has the capsules somewhat erect.

On rocks and roots of trees and on rotten wood, in moist woods; Europe, Asia, and from Arctic America to the northern United States. Rare in our region.

Elk : Benezette. McMinn. (Porter's Catalogue).

6. **Isopterygium micans** (Swartz) E. G. Britton.

(*Hypnum albulum* C. Mueller; *H. micans* Swartz; *Sematophyllum micans* Braithwaite).

Small, thinly matted, loose, glossy, whitish-green to yellowish-green: stems prostrate, rooting, irregularly branching; leaves loose, erect-spreading to secund and pointing upwards, very small, about 0.8–1.2 mm. long, ovate-lanceolate, gradually long-acuminate, serrulate above, thin; costa usually none; perichætial leaves abruptly acuminate, the inner apically serrate; median leaf-cells linear, prosenchymatous, flexuous, about 15–18:1, at the base a row considerably enlarged and broad, at the angles a few sub-quadrate: seta long and slender; capsule very small, ovate-oblong, light castaneous, constricted below the mouth when dry and empty, slightly incurved; peristome-segments not split, about as long as teeth, the cilia 1 or 2, short, nodose; annulus none; lid conic, apiculate to short-rostrate; spores mature in mid-winter.

On earth and rotten wood in moist woods; mainly along the eastern United States from New York southwards. Rare in our region.

Center : Bear Meadows. T. C. Porter. (Porter's Catalogue).

7. **Isopterygium turfaceum** (Lindberg) Lindberg.

(*Hypnum turfaceum* Lindberg; *Stereodon turfaceus* Mitten; *Plagiothecium turfaceum* Lindberg).

(Plate XLVII)

Small, light green to yellowish-green, loosely matted: stems prostrate, more or less pinnately branching with short branches, rooting at the perichætia and at the main forks and usually quite difficult to separate from the substratum without breaking in pieces; leaves about 1.5 mm. long, complanately arranged, lance-ovate, long-acuminate from an ovate-oblong base, sharply serrate above the middle, margins plane, serrulate, or entire towards the base; costa none or very short and faint; perichætial leaves ovate, basally concave, abruptly short-pointed, dentate at apex; median leaf-cells fusiform to

broadly linear, prosenchymatous, about 8–12:1, the basal a little shorter and wider, the alar either not differentiated or a few sub-quadrate to rectangular and incrassate: seta slender, about 1.5 cm. long, castaneous, somewhat twisted; capsule oblong, about 2–3:1, about 2 mm. long, slightly curved and somewhat inclined when young, when old and empty arcuate, horizontal, plicate, castaneous, and constricted below the mouth; annulus large, double; lid conic; exothecial cells small and rounded in three or four series at the rim, gradually becoming oblong-rectangular or irregular-oblong below, the upper more or less distinctly castaneous-collenchymatous; peristome small, the teeth lance-subulate, papillose above, dorsally transversely striolate below, strongly trabeculate and lamellate, slightly confluent at base; segments nearly as long, narrow, not split, papillose, yellowish, basal membrane about two-fifths as high; cilia strong, nodose, often about as long as the segments, 1 or 2 in number; spores more or less greenish-yellow, about .008–.011 mm., papillose, rather thin-walled.

On rich woods-humus in moist woods or in peat bogs; Europe, and from Canada to Georgia and Texas. Uncommon in our region.

Cambria	: Ebensburg. T. P. James. (Porter's Catalogue).
Crawford	: In swamp near Hartstown, May 29-31, 1909. O. E. J. and G. K. J. (Figured).
McKean	: East Branch Swamp, Bradford, July 1, 1896. D. A. B.

19. *PLAGIOTHECIUM* Bryologia Europæa.

Autoicous or dioicous, rarely polyoicous: usually more or less robust, mostly softly cespitose, bright to yellowish or whitish-green, lustrous: stems creeping to ascending, or in thick cushions erect, with ascending and small-leaved stolons, mostly irregularly branched; branches often elongate-flagelliform; paraphyllia none; leaves uniform, obliquely inserted, non-plicate, distichous, concave from a narrow and more or less decurrent base, broadly lanceolate to ovate, acuminate, mostly plane-margined and entire; costa short, mostly double, sometimes none; median leaf-cells chlorophyllose, elongate-rhomboid to linear, thin-walled, the basal shorter and wider, the alar lax and hyaline: seta long, reddish, drying twisted; capsule erect to cernuous, with collum, oblong to cylindric, symmetric to weakly dorsally gibbous, drying wrinkled or smooth and often arcuate; annulus mostly revoluble; peristome-teeth yellowish, confluent basally, lance-subulate, mostly hyaline-bordered, the divisural zigzag, the teeth dorsally cross-striate, numerously lamellate; lid convex-conic, acute to rarely rostrate.

A genus of about 35 species, mostly growing on rocks and stones, rare in the tropics; about 17 species in North America; at least 4 species in our region.

Key to the Species.

a. Leaves spreading more or less uniformly in all directions. b.

a. Branches distinctly complanately flattened. c.

b. Leaves entire. 2. *P. roeseanum.*

b. Leaves more or less serrulate. 1. *P. striatellum.*

c. Costa strong, forked, often reaching to the middle of the leaf: capsule usually striate when dry. 3. *P. sylvaticum.*

c. Costa thin, short: capsule usually smooth when dry. 4. *P. denticulatum.*

1. **Plagiothecium striatellum** (Bridel) Lindberg.

(*Hypnum muehlenbeckii* Schimper; *Plagiothecium muehlenbeckii* Bryologia Europæa; *Leskea striatella* Bridel).

(Plate XLVII)

Slender, dense, dark green, lustrous: stems prostrate, branches crowded, erect or ascending, straight or slightly curved; leaves about 1–1.3 mm. long, crowded, sub-complanate, the branch-leaves squarrose-spreading, ovate-lanceolate or triangular-lanceolate with a long slender and flexuous acumen, plane-margined, serrulate above at least, the base strongly decurrent; costa double and faint; median leaf-cells linear-fusiform, flexuous, rather short, about 6–10:1, the basal somewhat larger, the alar abruptly very much enlarged, inflated, hyaline to colored, and forming the much decurrent and plainly distinct auricles; inner perichætial leaves half-sheathing, the apex filiform-flexuous and usually recurved: yellowish, about 2 mm. long, slightly curved, oblong-cylindric with a tapering neck, distinctly striate when dry; lid conic, rather obtuse; annulus large, compound; exothecial cells minute and rounded in three to five series at the rim, below rapidly becoming irregularly oblong and more or less incrassate; teeth short, yellowish, papillose above, dorsally cross-striolate below, lamellate, strongly trabeculate, slightly confluent at base; segments about as long, slender, pale, granulose, only slightly carinately cleft; basal membrane only about one-fourth to one-third as high as the teeth; the cilia 1 to 3, a little shorter than the segments; spores mature in late spring or early summer, yellowish, papillose, rather incrassate, .007–.010 mm.

On earth, rocks, and rotten logs, in woods, usually in non-calcareous habitats; Europe, and from Arctic America south to North Carolina. Rare in our region.

Cambria : Ebensburg. T. P. James. (Porter's Catalogue).

McKean : On sandstone rocks, Rutherford Rocks, altitude 2000 feet, July 7, 1894, Divide between Hawkins and Rutherford Hollows, April 25, 1893, and March 12, 1894, and Langmade, May 9, 1896. (Figured). All near Bradford. D. A. B.

Lawrence : Slippery Rock Creek, 1906. Miss Susan Gageby.

2. **Plagiothecium roeseanum** (Hampe, mss.) Bryologia Europæa.

(*Hypnum sullivantiae* Schimper; *H. roeseanum* Hamps).

Compactly cespitose, pale green to yellowish-green, shining: stems more or less erect, sparsely branched, radiculose at base; leaves crowded, sub-imbricate, ovate-oblong, abruptly and shortly filiform-acuminate, serrulate towards the apex; thin, concave, glossy, the leaves hardly complanate but the branches appearing julaceous; costa bifid, rather long and strong; median leaf-cells narrowly linear, about 15:1, the basal scarcely different, a little broader and shorter; perichætial leaves erect, the inner oblong, narrowly acuminate: capsule cylindric-oblong, erect to sub-inclined, smooth when dry, constricted at the neck; lid conic, obliquely short-rostrate; annulus large, simple; peristome hypnoid, the 2 cilia strong and about as long as the entire segments; spores mature in summer.

On stones and earth in moist or swampy woods; Europe, Asia, and from Nova Scotia to Alaska and south to Florida. Not yet found in our region.

3. **Plagiothecium sylvaticum** [Hudson] Bryologia Europæa.

(*Hypnum silvaticum* Hudson; *H. denticulatum* C. Mueller).

(Plate XLVII)

Both this and *P. roeseanum* are perhaps but varieties of *P. denticulatum,* but until better known should probably be kept apart as separate species. Tufts large, dull or but slightly glossy, deep olive-green to yellowish-green; stems prostrate, stoloniferous; leaves rather soft, large, concave about 2–3 mm. long, not very regularly complanate, widely spreading, shrinking and somewhat twisted when dry, broadly ovate-lanceolate, narrowed considerably towards the decurrent base, tapering abruptly to the acute, entire or obsoletely denticulate apex, plane-margined; costa rather faint, double, often reaching one-third the length of the leaf; median leaf-cells about 8–10:1, about .016 mm. wide, large, hexagonal-rhomboid, the alar cells numerous and quadrate-oblong, sub-inflated, hyaline and decurrent; perichætia bearing rhizoids at base, about 3 mm. high, the leaves sheathing with a flexuous acumen, noncostate; seta castaneous, slender, about 2–4 cm. long, dextrorse

above when dry; capsule yellowish, about 2 mm. long, cylindric from a tapering neck, inclined, arcuate, smooth, but when dry and empty somewhat striate; lid conic, acuminate to subrostrate, about one-half as long as the urn; peristome-teeth bright orange at base, pale above, lance-subulate, confluent at base, closely trabeculate, the dorsal lamellæ finely cross-striolate; segments slender, about as long as the teeth, narrowly carinately gaping, the basal membrane about one-third as high, the cilia very slender, about as long as the segments, nodose, usually 3 in number; exothecial cells moderately incrassate, small and quadrate at rim, larger and oblong-rectangular to rounded-hexagonal below; annulus large, revoluble, 2-seriate; spores pale yellowish, smooth, rather thin-walled, .006–.010 mm., mature in mid-summer.

On humus, rocks, rotten logs, etc., in woods; Europe, Asia, northern Africa, and from southern Canada to Alabama and from Alaska to Oregon. Probably more common in our region than the localities here enumerated would indicate.

Allegheny	: Panther Hollow, Schenley Park, Pittsburgh, November 25, 1905, and Wildwood Road Hollow, June 11, 1908. (Figured). O. E. J.; Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J.
Crawford	: Linesville, May 12, 1908. O. E. J.
Westmoreland	: "Shades," near Blackburn, June 13, 1908. O. E. J.
McKean	: Marilla Brook, Bradford, October 22 and November 16, 1896. D. A. B.

4. **Plagiothecium denticulatum** [Linnæus] Bryologia Europæa.

(*Hypnum denticulatum* Linnæus).

(Plate XLVIII)

Variable, in flattened tufts of a pale and lustrous green, moderately robust, the more or less ascending and elongate branches complanate; leaves rather close, complanate and subdistichous, rather spreading, when dry little changed, glossy, 2–3 mm. long, sub-concave, oval to lance-oblong, shortly and sometimes almost apiculately acute, usually slightly denticulate at the apex, the lower margins entire and often narrowly recurved, the base narrowed to a rather wide and strongly decurrent insertion; costa thin, variable, usually short and double, sometimes forked and reaching almost to the middle, sometimes none; median leaf-cells rhomboid-hexagonal, rather large, about 10–15:1, about .010–.015 mm. wide, thin-walled, chlorophyllose, gradually becoming laxer, pellucid, and more or less rectangular at base, the alar more hyaline, sub-rectangular, sub-inflated, and still somewhat larger but not form-

ing clearly differentiated auricles, strongly decurrent; the apical leaf-cells much smaller, incrassate, rhomboid: seta about 2.5–4 cm. long, flexuous, dextrorse above when dry, slender; capsule-urn about 2.5 mm. long, sub-erect to horizontal, cylindric and with a distinct neck, arcuate to nearly symmetric, when dry and empty sometimes striate; lid conic, obtusely acuminate to long-acuminate, about one-third as long as the urn; annulus usually 2-seriate, large, revoluble; exothecial cells rounded-quadrate, small at rim, gradually larger and more oblong below, all incrassate; peristome-teeth lance-subulate, hyaline and papillose above, yellowish and dorsally cross-striolate below, strongly lamellate and trabeculate, confluent at base; segments slender, as long as the teeth, basal membrane one-third as high, cilia 2 or 3, usually 3, slender, nodose; spores smooth, medium-walled, yellowish, .008–.011 mm., mature in summer.

On stones, humus, and rotten wood, in moist forests; cosmopolitan in temperate and cooler regions; in North America from the Arctic regions to the northern United States. Very common in our region.

Allegheny	: Eighteen pockets determined, collected in various localities, mainly on earth or rocks in ravines. Mostly O. E. J. and G. K. J.
Butler	: On base of *Quercus platanoides,* in low ground along Brush Creek, Crider's Corners, April 26, 1908. O. E. J.
Cambria	: Ebensburg. T. P. James. (Porter's Catalogue).
Clearfield	: Between Clearfield and Pottersdale, July 12, 1908. O. E. J.
Erie	: Presque Isle, May 8-9, 1906. O. E. J.
Fayette	: Ohio Pyle, May 30-31, 1908. O. E. J. and four miles south of Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.; Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
Jefferson	: Falls Creek, July 18, 1904. O. E. J. (Figured).
Lawrence	: Gorge below Ellwood City, June 26, 1909. O. E. J.
McKean	: Bolivar Run, September 6, 1897. D. A. B.
Westmoreland	: Miss K. R. Holmes, Apollo, 1902; two miles south of Trafford, August 21, 1910. O. E. J. and G. K. J.

Family XXXII. *SEMATOPHYLLACEAE.*

Autoicous or dioicous; antheridial clusters gemmiform, small; archegonial clusters on very short, usually rooting, perichætial branches: slender to robust, cespitose, green to yellowish or brownish, often lustrous: stem without central strand, creeping to ascending, mostly irregularly branched, sometimes more or less regularly pinnate; paraphyllia none; leaves pluriseriate, mostly uniform and symmetric, of various forms; costa double, very short or none; cells mostly prosenchymatous, smooth or papillose, in the leaf-angles one row being oblong, inflated, thin-walled: capsule exserted, mostly cernuous to pendent, mostly oval to oblong, usually unsymmetric, collum weak; exothecial cells collenchymatous; annulus none; peristome-teeth as long as the segments, the latter rarely lacking, the teeth mostly entirely separate, mainly dorsally striate, lamellæ mostly well-developed, inner peristome free; basal membrane high, segments mostly carinate and lance-subulate, rarely filiform, cilia usually present; spores mostly small; lid from a convex-conic base slenderly rostrate; calyptra mostly cucullate and glabrous.

A rather large family almost exclusively of tropic and subtropic distribution and mostly living on trees; in our region there occurs but one genus, as follows:

1. *RHAPHIDOSTEGIUM* (Bryologia Europæa) DeNotaris.

Usually autoicous: slender to robust, mostly densely and widely cespitose, dark to pale green or yellowish to brownish: stem creeping, more or less elongate, regularly pinnately branched or irregular, with branches horizontally spreading to erect, rather julaceous; leaves uniform, non-plicate, concave, oval to oblong or oblong-elliptic, obtuse to piliferous-acuminate; usually ecostate, rarely obsoletely bi-costate; cells narrowly prosenchymatous, the apical sometimes rhombic, the basal golden-yellow, narrowly rectangular, incrassate and porose, the alar oblong, inflated, hyaline to yellowish or red-brown and forming a small, non-excavate group bounded above by small quadrate cells: seta long, mostly smooth; capsule sub-erect or horizontally inclined, oval to oblong, smooth; peristome hypnoid, teeth lance-subulate, with divisural zigzag, hyaline-bordered, prominently lamellate, especially so in the upper third; peristome-segments yellowish, carinate, with a high basal membrane, mostly split, cilia 1 or 2, nodose, or sometimes rudimentary; spores small, lid slenderly subulate-rostrate; calyptra glabrous.

A genus of about 250 species of temperate and warmer regions, occurring mainly on trees and rocks; about 40 species occur in North America; 3 or possibly 4 species in our region.

Key to the Species.

a. Capsules erect and symmetric or nearly so; leaves secund upwards and branches curved at ends. 3. *R. adnatum.*
a. Capsules more or less inclined to horizontal; leaves erect-spreading in all directions, or somewhat secund. b.
b. Leaves serrate, sub-orbicular. 2. *R. novae-caesareae.*
b. Leaves entire or nearly so; oblong-ovate to more or less lanceolate. c.
c. Leaves usually more than 2 mm. long. (*R. marylandicum* (C. M.) Jaeg and Sauerb.)
c. Leaves usually less than 1.5 mm. long. 1. *R. carolinianum.*

1. **Rhaphidostegium carolinianum** (C. Mueller) Jaeger.

(*Hypnum carolinianum* C. Mueller; *H. demissum* var. *carolinianum* Lesquereux and James; *Sematophyllum carolinianum* E. G. Britton).

(Plate XLVIII)

Rather dark green, drooping-cespitose, lustrous: stems irregularly branching, often buried in the sand and then more or less leafless and with erect to ascending simple branchlets about 1–1.5 cm. long; leaves imbricate, more or less secund or complanate above, non-plicate, concave, lance-ovate or lance-oblong, more or less sub-serrulate at apex, shortly acute, the margin often rather broadly reflexed; costa none, or faintly indicated by striæ; median leaf-cells linear-flexuous, small, incrassate, about 8–10:1, towards the base shorter and broader, the alar abruptly much enlarged and inflated to form a group of 2–8 pellucid and hyaline or colored cells; perichætial leaves rather closely imbricate, lance-oblong, acuminate: seta erect, sinistrorse below, castaneous, about 1 cm. long; capsule curved and inclined, constricted below the mouth when dry and empty, the urn about 1.2–1.5 mm. long, oblong-pyriform, yellowish; exothecial cells rounded-hexagonal, collenchymatous; peristome orange-yellow, the teeth with distinct divisural and lamellæ, dorsally cross-striolate, hyaline-margined, strongly trabeculate; segments about as long, slender, rarely split, the cilia 1 (or 2), about one-half to two-thirds as long as segments, the basal membrane about two-fifths the height of the peristome; lid comparatively large, the beak oblique, subulate, and about two-thirds to three-fourths as long as the urn; spores smooth, yellowish-incrassate, usually chlorophyllose, about .014–.018 mm., mature in summer or early autumn.

On wet non-calcareous rocks, mainly in ravines in hilly or mountainous districts; Asia, and from Newfoundland southwards to Georgia. Probably not uncommon in our region.

Allegheny : Haysville Hollow, September 20, 1908. O. E. J.; on damp rocks under hemlocks, Wildwood Road, November 19, 1908. O. E. J. and G. K. J.

Fayette : On damp rocks in deep hollows and ravines, Ohio Pyle, September 1-3, 1906, and September 1-3, 1907. O. E. J. and G. K. J. (Figured); also May 30-31, June 13, and July 4, 1908. O. E. J.; Ohio Pyle, June 15, 1902. J. A. S.

2. **Rhaphidostegium novae-caesareae** (Austin) Renauld and Cardot.

(*Hypnum micans* Wilson, not Swartz; *Rhynchostegium novae-caesareae* Austin).

(Plate XLVIII)

Small, yellowish-green, glossy, forming wide, thin mats: stems prostrate, very slender, sparsely branching, the branches short, simple or sparsely branched, sub-erect; leaves spreading or the upper sometimes sub-secund, sub-orbicular, apiculate to shortly acuminate, 0.6–0.8 mm. long, serrulate, very concave, the margins somewhat reflexed below; costa double and very faint; median leaf-cells linear, flexuous, about 6–10:1, the apical rhomboid-oblong, rather incrassate, much smaller than the median, the basal a little shorter and wider than the median, the alar region with about 6 to 10 larger, quadrate to rectangular, rather incrassate cells and with the outermost one to three cells much larger and more or less inflated: the capsules of this species have thus far been found but once,—on damp rocks along Stony Creek, Carbon County, Pennsylvania, by Francis Wolle: capsules small with a shortly rostrate lid, the exothecial cells non-collenchymatous: dioicous.

On damp rocks in cool and moist mountain ravines from New York and New Jersey southwards in the mountains. Rare in our region.

McKean : Bennett Brook, July 10, 1898. D. A. B. (Figured).

3. **Rhaphidostegium adnatum** (Richard) Bryologia Europæa.

(*Leskea adnata* Richard; *Rh. microcarpum* Jaeger; *Leskea microcarpa* Bridel; *Sematophyllum adnatum* E. G. Britton).

Small, in tangled, thin, green to golden-green mats: stems prostrate, with short and incurved branches; leaves rather closely imbricate when dry, sub-homomallous, the upper usually distinctly secund, narrowly oblong-lanceolate, the apex rather shortly acuminate, subserrulate to entire, margins quite broadly reflexed; costa double but very short and faint; median leaf-cells linear-fusiform, flexuous, about 8–12:1, shorter and wider at the base, towards the angles a border of sub-rectangular and scarcely inflated cells and at the extreme angle a few distinctly inflated alar cells: seta short and smooth,

about 5–8 mm. long; calyptra more or less persistent, cucullate, reaching to a little below the mouth of the urn; capsule castaneous, about 1–1.3 mm. long, oblong to oblong-cylindric, about 2–2.5:1, erect and symmetric or nearly so, thin-walled but with collenchymatous exothecial cells, slightly constricted below the reddish rim when dry and empty; annulus none; lid obliquely subulate-rostrate from a conical base, about as long as the urn; peristome-teeth with an unusually distinct and heavy divisural, cilia single and usually about half as long as the usually entire segments, basal membrane reaching to about one-third the height of the inner peristome; spores mature in late summer to fall.

On base of trees; in moist woods from southern New England to Ohio and southwards to the Gulf States. Not yet found in our region.

Family XXXIII. *BRACHYTHECIACEAE.*

Autoicous or dioicous; paraphyses filiform; antheridial clusters gemmiform; archegonial clusters on very short, rooting branches: slender to robust: stem with central strand, creeping to ascending, or rarely erect, often interruptedly stoloniferous, fasciculately radiculose, mostly irregularly pinnate; branches mostly acute, often flagelliform and rooting at the ends; leaves unistratose, pluriseriate, erect-spreading or appressed, rarely homomallous, dimorphic in the stoloniferous species; cordate-oblong to lance-ovate or lanceolate, acuminate or rarely obtuse; costa mostly incomplete; median leaf-cells prosenchymatous, elongate-rhomboid to linear-vermicular, smooth or rarely papillose towards the upper end of the cell, the basal cells lax and often porose, the alar usually differentiated, being quadrate, green or hyaline, never inflated: seta elongate, often rough; capsule cernuous to horizontal, mostly short, ovate or oblong and dorsally gibbous, when dry and empty more or less arcuate, rarely erect and symmetric, oval to oblong-cylindric, never pendent, smooth; collum faint; exothecial cells collenchymatous; peristome hypnoid; teeth lance-subulate, mostly strongly hygroscopic, basally confluent, yellow or orange to red-brown, with a zigzag divisural, dorsally cross-striate, lamellæ numerous and well-developed; inner peristome mostly free, with a high basal membrane, carinate segments which are lance-subulate, cilia mostly complete, rarely none or rudimentary; lid conic, obtuse to acute, often long-rostrate; calyptra cucullate, early deciduous, mostly glabrous.

A large and cosmopolitan family on various substrata, containing about 20 genera with 460 species.

Key to the Genera.

a. Capsule erect and symmetric; basal membrane mostly low. 1. *Homalotheciella.*
a. Capsule cernuous to horizontal, unsymmetric; basal membrane mostly high. b.
b. Leaves with several deep plications. 2. *Camptothecium.*
b. Leaves not deeply plicate. c.
c. Lid conic, sometimes acute; alar cells differentiated. 3. *Brachythecium.*
c. Lid long-rostrate; alar cells few or none. d.
d. Cells narrow, smooth. e.
d. Cells oblong-rhomboidal to oblong-hexagonal, those of the branch-leaves more or less rough dorsally. 7. *Bryhnia.*
e. Leaves complanate. 8. *Rhynchostegium.*
e. Leaves imbricated or spreading. f.
f. Leaves deeply concave, spoon-like, abruptly piliferous-acuminate. 4. *Cirriphyllum.*
f. Leaves plane or somewhat concave, acute or gradually acuminate, not piliferous. g.
g. Seta smooth in our species; leaves not much concave, nonplicate. 5. *Oxyrrhynchium.*
g. Seta rough or smooth: leaves mostly concave and plicate. 6. *Eurhynchium.*

1. *HOMALOTHECIELLA* (Cardot) Brotherus.

Autoicous: slender, soft, laxly cespitose, green, lustrous: stem creeping, elongate, beset thickly with obtuse, short, ascending to erect, densely-leaved branches which are often arcuate when dry; paraphyllia none; when dry the leaves imbricate, when moist erect-spreading, non-decurrent, nonplicate, concave, oval to oblong, the apex acuminate to lance-subulate, upper half of leaf serrulate to entire; costa simple, sometimes reaching to mid-leaf; median leaf-cells oblong-elliptic, thin, smooth, the alar green, numerous, quadrate; inner perichætial leaves abruptly serrate-subulate from a sheathing base; seta about 7 mm. long, castaneous, rough; capsule erect to sub-erect, weakly unsymmetric, oblong, drying somewhat constricted below the mouth and often subarcuate; annulus present; inner peristome much shorter than the outer, teeth basally confluent, lance-linear, dorsally cross-striate, apically papillose, lamellæ laterally projecting; inner peristome somewhat united with the outer, yellow, smooth, with low basal membrane, segments short, narrow, entire, cilia none; lid long-rostrate; calyptra slightly hairy at base.

A small genus of three North American species; one species occurring in our range.

1. **Homalotheciella subcapillata** (Hedwig) Brotherus. (*Pterigynandrum subcapillatum* Hedwig; *Homalothecium subcapillatum* Sullivant).

Forming light green, thin, glossy mats: stems prostrate, irregularly branching; leaves loosely imbricate when dry,

elliptic-oblong, abruptly long-acuminate, more or less serrate above, about 0.9–1.2 mm. long, concave, non-plicate, not papillose; costa usually reaching about to the middle of the leaf; median leaf-cells, about 8–10:1, fusiform-elliptic, towards the apex somewhat shorter, the alar quadrate, numerous and forming a group which extends upwards along the margin to often one-third the length of the leaf; inner perichætial leaves sheathing, long-acuminate: seta rough, about 6–9 mm. long, slender; capsule about 2–3.5:1, sub-erect, slightly incurved, dorsally somewhat gibbous, slightly constricted below the mouth when dry; peristome-teeth confluent at base, dark red, with a broad pellucid central stripe marked by a delicate medial line, the segments adhering to and lining the teeth inside, forming a hyaline border; spores mature in autumn.

On bark of trees and on fallen trunks in woods; in the eastern United States from New England to North Carolina. Rare in our region.

Elk : McMinn. (Porter's Catalogue).

2. *CAMPTOTHECIUM* Bryologia Europæa.

Dioicous and pseudautoicous: slender to robust, widely cespitose, mostly yellowish-green, drying stiff, mostly lustrous: stem elongate, procumbent to ascending to erect, thickly-leaved, sometimes stoloniferous, more or less regularly pinnate; leaves erect-spreading, sometimes weakly secund, non-decurrent or but scarcely decurrent, slightly concave, strongly plicate, lance-oval, subulate-acuminate, serrulate all around; costa simple, ending near or in the apex; median leaf-cells prosenchymatous, vermicular, thin, smooth, or with weakly projecting upper angles, the basal lax, yellow, porose, the alar numerous, quadrate; perichætium not rooting, inner perichætial leaves much elongate and abruptly subulate: seta moderately long, castaneous, mostly rough, drying twisted; capsule cernuous to horizontal, dorsally gibbous, oblong to oblong-cylindric, more or less curved; annulus present; peristome-teeth basally confluent, linear-subulate, bordered, dorsally cross-striate, thickly lamellate; inner peristome of same length, free, the segments broad and carinately split, cilia strong and nodose; lid conic-acute to thickly rostrate; calyptra glabrous.

A genus of about 15 species, confined mainly to temperate regions on soil, bark of trees in woods, or in swamps; a number of species occur in the West, but in our region only the following:

1. **Camptothecium nitens** [Schreber] Schimper.
(*Hypnum nitens* Schreber).

A striking species by reason of its bright yellow or golden color, silky lustre, strongly plicate leaves, and stems densely

covered by a felt of reddish radicles: the stems often reach a length of 10 cm., strong; the elongate-lanceolate leaves entire, strongly plicate, marginally revolute, gradually and evenly narrowed to the slender apex, reaching usually over 3 mm. long; median leaf-cells linear, the basal shorter with very thick and porose walls, the alar broader and short-rectangular to sub-quadrate but rather few in number and not forming a very distinct auricle: seta smooth; capsule cylindric, arcuate.

In wet meadows, bogs, and swamps; Europe, Asia, and from Arctic America to northern United States. Occurs in Eastern Pennsylvania but not yet reported in our region.

3. *BRACHYTHECIUM* Bryologia Europæa.

Autoicous or dioicous: slender to robust, mostly widely and flatly cespitose, green or yellowish-green to whitish, sometimes lustrous: stems creeping or procumbent, sometimes more or less erect, thickly-leaved, irregularly divided, interruptedly pinnate, stolon-like at the apex; stem and branch-leaves unlike, stem-leaves erect-spreading to spreading, more or less concave, mostly plicate, narrowly lanceolate from a narrowed, ovate or triangular-cordate and decurrent base, acuminate, marginally plane, serrate all around or only towards the apex, rarely entire; costa simple, usually long but rarely complete; median leaf-cells narrow to moderately wide, elongate-rhomboid to linear, smooth, the basal more lax, and shorter, the alar quadrate to rectangular or oblong-hexagonal, forming a rather indefinitely bounded group; branch-leaves mostly shorter, narrower, with a somewhat weaker costa; inner perichætial leaves slenderly and finely acuminate: seta more or less long, smooth to rough; capsule cernuous to horizontal, rarely erect, mostly short-oval and dorsally gibbous, rarely oblong-cylindric, slightly arcuate when dry and empty; usually annulate; peristome-teeth strong, basally confluent, dorsally cross-striate, apically papillate, thickly lamellate; inner peristome about the same length, yellow to orange, free, with wide basal membrane, the segments broadly lanceolate, long-acuminate, carinately split and often gaping, cilia complete, nodose to appendiculate, rarely rudimentary or lacking; lid conic-convex, obtuse to acute; calyptra glabrous.

A genus of about 190 species, occurring on various substrata, mostly confined to temperate regions; in North America about 55 species; at least 14 species in our region.

Key to the Species.

a. Seta smooth. b.
a. Seta rough, at least in part. g.
b. Annulus none, cilia rudimentary or none. c.
b. Annulus often present; cilia well-developed. d.

c. Middle leaf-cells about 4–8:1; slender plants. 1. *B. cyrtophyllum.*
c. Middle leaf-cells about 9:1; rather robust. 2. *B. acuminatum.*
d. Capsules sub-erect, narrowly cylindric-oblong; usually more than 3:1. 3. *B. oxycladon.*
d. Capsules cernuous, less than 3:1. e.
e. Stem-leaves narrowed gradually from base to acuminate apex, non-plicate. 7. *B. acutum.*
e Stem-leaves ovate-lanceolate, more or less plicate. f.
f. Stem-leaves broad, about 1 mm. at base. 5. *B. salebrosum.*
f. Stem-leaves narrow, about 0.5–0.6 mm. at base. 6. *B. flexicaule.*
g. Seta rough only above. h.
g. Seta rough throughout. j.
h. Costa percurrent or very nearly so. 13. *B. populeum.*
h. Costa ending about in middle of the leaf. i.
i. Leaves more or less plicate: cilia non-appendiculate. 4. *B. campestre.*
i. Leaves non-plicate: cilia appendiculate. 14. *B. flagellare.*
j. Cilia appendiculate. k
j. Cilia non-appendiculate. l.
k. Costa percurrent or sub-percurrent. 10. *B. reflexum.*
k. Costa distinctly incomplete. 11. *B. starkii.*
l. Leaves very short-acuminate, non-decurrent. 9. *B. rivulare.*
l. Leaves gradually acuminate. m.
m. Slender; leaves lanceolate, often secund. 12. *B. velutinum.*
m. Robust; leaves ovate to lance-ovate, not secund. 8. *B. rutabulum.*

1. **Brachythecium cyrtophyllum** Kindberg.

(Plate XLVIII)

Cespitose, lustrous, dark green: stems irregularly branching to sub-pinnate, creeping, up to 4 to 6 cm. long; stem-leaves lance-ovate, up to 1 or 1.5 mm. long; branch-leaves similar but narrower and smaller, lance-ovate to ovate, acute to short-acuminate, 0.6–0.8×0.3 mm., rather close, loosely appressed when dry, serrulate at least in the upper half, marginally reflexed at base, not plicate, not decurrent, when moist more or less spreading; costa stout, reaching about two-thirds the length of the leaf; median leaf-cells rhomboid-fusiform, about 4–8:1, the alar sub-quadrate, numerous, sub-inflated, somewhat chlorophyllose; perichætial leaves ecostate, half-sheathing: seta about 2–2.5 cm. long, dextrorse above, erect, flexuous; capsule erect, cylindric, sometimes slightly curved, from 1.5 to 3 mm. long, castaneous, smooth; annulus none; peristome-teeth slender, pale castaneous, confluent at base, hyaline and papillose above, the dorsal lamellæ closely cross-striolate below, the trabeculæ close and strong; segments nearly as long as the teeth, slender, pale yellowish, more or less carinately split, the cilia rudimentary or none; basal

membrane about one-fourth the height of the teeth; lid high-conic, usually acutely apiculate; spores papillose, brownish, medium- to thick-walled, .012–.016 mm., mature in autumn. Very closely related to the following species, which it apparently replaces to the west and northwest of our region.

On roots and bases of trees and on old logs, in woods from our region northwestward to Minnesota and Ontario. Uncommon in our region.

Allegheny : Fern Hollow, Pittsburgh, on old logs in ravine, January 21, 1906 (Figured), and March 8, 1908. O. E. J.

McKean : Bradford. D. A. B. (Porter's Catalogue).

2. **Brachythecium acuminatum** (Hedwig) Kindberg.

(*Leskea acuminata* Hedwig; *Hypnum acuminatum* Beauvois).

(Plate XLIX)

Widely and somewhat densely cespitose, dark to yellowish-green, glossy: stems slender, prostrate, up to 5 to 8 cm. long, bearing rhizoids, at least near the perichætia, rather distantly and unequally branched, the branches two-ranked, plumose to sub-julaceous, acute, not usually more than 1 cm. long; stem-leaves close, erect-spreading, lance-ovate to ovate, about 1–1.5 mm. long, acuminate, concave, with the borders reflexed below, the upper half serrulate, the leaf non-plicate or but slightly plicate; narrowed and somewhat decurrent at the base; costa usually reaching beyond the middle of the leaf; branch-leaves similar to the stem-leaves but relatively narrower and smaller; median leaf-cells linear-flexuose, about 8–12:1, medium-walled, prosenchymatous with rounded ends, apical cells a little shorter, the basal sub-quadrate or sub-rectangular, the alar numerous and sub-quadrate to quadrate, rather thin-walled and sub-inflated: seta erect, castaneous, flexuous, about 1–1.5 cm. long; capsule castaneous, erect, the urn 1.5–3 mm. long, sometimes slightly curved, cylindric, about 3.5–4.5:1, tapering at base; lid high-conic, acute to apiculate; exothecial cells densely yellowish-incrassate, small, rounded but varying to quite irregular in size and shape but with rounded corners; peristome-teeth narrow, castaneous, numerously trabeculate, hyaline and papillose above, dorsally cross-striolate below, the lamellæ distinct, teeth confluent at base; segments about as long as the teeth, narrow, carinately split, cilia rudimentary or none, the basal membrane only about one-fourth as high as the teeth; annulus none; spores castaneous, papillose, medium-walled, about .014–.018 mm., mature in late fall or in winter.

On earth, woods-humus, roots and bases of trees, stones, and very often on rotten logs, forming wide mats, in woods

from the southern part of Canada to the Gulf States and Colorado. Rather common in our region.

Allegheny : Thirteen pockets determined from various localities, mainly on old logs in ravines. O. E. J. and G. K. J.; Fern Hollow, January 21, 1906. O. E. J. (Figured).

Clearfield : Philipsburg. T. P. James. Porter's Catalogue).

McKean : Gate's Hollow, Bradford, April 29, 1898. D. A. B. Issued as Grout's No. 116, North American Musci Pleurocarpi.

Westmoreland: Near Apollo, 1902. Miss K. R. Holmes; Greensburg, T. P. James. (Porter's Catalogue).

3. **Brachythecium oxycladon** [Bridel] Jaeger.

(*B. laetum* Bryologia Europæa; *Hypnum oxycladon* Bridel).

Cespitose, bright or yellowish-green: stems prostrate, branching unequally and irregularly, the branchlets attenuate at the apex and erect; leaves close, loosely imbricate, ovate in the stem-leaves and more lance-ovate in the branch-leaves, rather abruptly acuminate, concave, plicate, finely serrulate all around; costa rather narrow, extending about to mid-leaf; median leaf-cells long, narrow, about 8–10:1, flexuous, the basal more or less quadrate, the alar numerous, small, rather incrassate, the alar portion strongly decurrent: seta about 2.5 cm. long, flexuous, flattened and dextrorse when dry; capsule sub-erect, about 4:1, 3-4 mm. long, oblong-cylindric, when dry somewhat arcuate and often inclined; lid conic-acuminate; annulus none; peristome parts of about equal length, hypnoid, the cilia somewhat appendiculate, usually 2 in number; spores mature in fall.

On earth, rocks, roots and bases of trees, in woods, but not so frequently occurring on rotten logs as do some of the other species. Not yet discovered in our region.

4. **Brachythecium campestre** (Bruch) Bryologia Europæa.

(*Hypnum campestre* Bruch).

(Plate XLIX)

Very closely resembling *B. salebrosum*, but differing in having the seta smooth at base and slightly rough above. Grout notes that the leaves are usually looser and more distant—"*Mosses*," *page* 278. Otherwise the characters are as given for *B. salebrosum*.

On moist earth, rocks, or on rotten logs, usually preferring a non-calcareous habitat. Spores mature in winter. Europe, Asia, northern Africa, and, in North America, from Canada to the northern United States and south in the moun-

tains to Alabama and Colorado. Rather infrequent in our region.

Allegheny	: Darlington Hollow, Sharpsburg, October 25, 1908, and Power's Run, on shaded rock, November 30, 1909. (Figured). O. E. J.
Fayette	: Ohio Pyle, along Meadow Run Valley, four miles south of village, September 1-3, 1906. O. E. J. and G. K. J.
McKean	: Bennett Brook, August 26, 1894, and Quintuple, September 9, 1896. D. A. B. Both near Bradford.

5. **Brachythecium salebrosum** [Hoffmann] Bryologia Europæa.

(*Hypnum salebrosum* Hoffmann).

(Plate XLIX)

Widely cespitose in glossy, dark yellow-green mats: stems usually 5 or 6 cm. or more long, creeping and irregularly branching; stem-leaves lance-ovate, about 1.5–2.5×0.6–1.1 mm., in our region apparently somewhat smaller than most descriptions call for; branch-leaves similar, lanceolate, about 1.8–2.2×0.5–0.6 mm., abruptly slenderly acuminate, serrate above, entire or sub-serrulate below, concave, the lower margins narrowly reflexed, the narrow insertion decurrent, both kinds of leaves plicate and erect-spreading, costa thin, usually reaching to the middle or a little above; median leaf-cells linear-fusiform, flexuous, about 8–12:1, the basal shorter and broader, usually two or three rows of lax, rather large, oblong or sub-quadrate cells across the whole base of the leaf, the alar more numerous, lax, sub-quadrate, rather thin-walled, the alæ quite strongly decurrent; perichætial leaves filiform-acuminate, ecostate or nearly so: seta smooth, castaneous, about 2–2.5 cm. long, flexuous, flattened and twisted when dry; capsule oblong-ovoid, dorsally turgid, inclined to horizontal, usually somewhat arcuate, about 2–3:1, castaneous, the urn about 2–2.5 mm. long; the lid conic-acuminate, about 1 mm. long; annulus narrow; exothecial cells rounded-quadrate at the rim, larger and irregularly oblong or elliptic below, all strongly yellowish-incrassate; peristome-teeth slender, confluent at base, closely trabeculate and lamellate, dorsally cross-striolate and brownish below, hyaline and papillose above, rather prominently margined; segments about as long as the teeth, finely papillose, carinately split and usually gaping; cilia a little shorter, hyaline, nodose, 1 to 3 in number; basal membrane about one-third as high as the teeth; spores mature in

late fall or winter, about .015–.020 mm., the walls medium-incrassate, brownish, and somewhat papillose: autoicous.

On earth, stones, roots and bases of trees, rotten wood, etc., in moist, shady woods; said to be especially common in pine or hemlock woods; Europe, Asia, northern Africa, and from Arctic America southward to South Carolina and Missouri. Common in our region.

Allegheny	: Moon Township, 1888. J. A. S.; on rotten log, Fern Hollow, Pittsburgh, January 21, 1906, Douthett, April 26, 1908 (Figured), Guyasuta Hollow, Sharpsburg, November 9, 1908, and Keown, November 14, 1909. O. E. J.
Butler	: On humus under *Pinus rigida,* near Crider's Corners, December 29, 1908. O. E. J.
Crawford	: Pymatuning Swamp, Linesville, August 3, 1909. O. E. J.
Clinton	: Between Renovo and Haneyville, July 15, 1908. O. E. J.
Elk	: McMinn. (Porter's Catalogue).
McKean	: Langmade, Bradford, April 25, 1897, and Marilla Brook, Bradford, September 20, 1897. D. A. B.
Westmoreland	: Laurelville, May 30-31, 1903. J. A. S.; Hillside, May 22, 1909. O. E. J.

6. **Brachythecium flexicaule** Renauld and Cardot.

(Plate L)

Widely cespitose, yellowish-green: stems usually 3–6 cm. long, creeping, irregularly pinnate; leaves plicate, erect-spreading, the stem-leaves lanceolate, about 1.8–2.5×0.6–0.9 mm.; branch-leaves narrower, up to 2.4×0.5–0.7 mm., gradually slenderly acuminate from a deeply concave, somewhat decurrent plicate base with often narrowly reflexed basal margins, the margins serrulate above; costa extending to above the middle of the leaf; median leaf-cells linear-fusiform, prosenchymatous, flexuous, about 8–15:1, rather incrassate, the apical shorter, the basal rather abruptly shorter and wider with two to four rows of large oblong to rounded-quadrate cells across the whole median base, the alar cells sub-quadrate, rather incrassate, numerous, the wings decurrent; perichætial leaves up to 3 mm. long with slender flexuous acuminations, partly sheathing, ecostate or nearly so: seta smooth, castaneous, usually sinistrorse, 1.5–2.5 cm. long; capsule oblong-cylindric, inclined to nearly horizontal, dorsally gibbous, subarcuate, pale-castaneous, slightly narrowed below the rim when dry, the urn from 2–4 mm. long; lid conic-acuminate, about

1–1.3 mm. long; exothecial cells small and rounded at the rim, below larger and oblong to linear-oblong, all sharply yellowish-incrassate; annulus indistinct; peristome-teeth confluent at base, castaneous and dorsally cross-striolate below, closely trabeculate and lamellate, margined, hyaline towards apex; segments very slender, about as long as teeth, carinately cleft and gaping in median portion, yellowish, papillose, basal membrane one-fourth to one-third as high, the cilia somewhat shorter than the segments, filiform, nodose, hyaline-papillose; spores rather incrasste, smoothish, brown-walled, .013–.016 mm. According to Grout this is probably *B. salebrosum* variety *densum* Bryologia Europæa. In most characters it is quite similar to typical *salebrosum* but differs in having narrow leaves with evenly narrowed and very slender acuminations.

Ranging from New England and the Adirondacks to Tennessee, and occurring also in British Columbia. Rare in our region.

Allegheny : Guyasuta Hollow on clay and stones, October 12, 1908. O. E. J.

McKean : Bennett Brook, May 3, 1893. D. A. B. (Figured).

7. **Brachythecium acutum** (Mitten) Sullivant.

(*Hypnum acutum* Mitten).

Loosely cespitose, bright glossy green: stems long, flexuous, creeping, basally radiculose, sparsely branched; branchlets short, sometimes reflexed; leaves loose, open-spreading, more imbricate when dry, lanceolate to lance-ovate, non-striate, slightly decurrent, plane-margined, scarcely concave, obscurely serrulate or almost entire, short auriculate at base, the margins tapering gradually and almost in a straight line from base to apex; median leaf-cells linear-vermicular, about 10:1, the basal lax, the alar sub-quadrate, small, numerous and extending down to form a rather strong decurrent portion; costa reaching to somewhat above the middle; stem-leaves wider, triangular-ovate, reaching 2.5×1 mm., long and slenderly acuminate: seta smooth, about 1.5–2.5 cm., long, flexuous; capsule ovoid-oblong, dorsally turgid, inclined to horizontal, usually slightly arcuate, about 2–3:1; annulus narrow; peristome hypnoid, the cilia 2 or 3, strongly nodose to sub-appendiculate; lid conic-acuminate; spores mature in late fall or winter.

In moist woods on rotten logs and earth; Canada and the northern United States, south to Arkansas. Rare in our region.

McKean : D. A. B. (Porter's Catalogue).

8. **Brachythecium rutabulum** [Linnæus] Bryologia Europæa.
(*Hypnum rutabulum* Linnæus).
(Plate L)

Widely and loosely cespitose, yellowish-green, glossy: stems prostrate, creeping, often stoloniferous at the end, the branchlets more or less erect and attenuate; stem-leaves large, cordate-ovate to more or less deltoid, or narrower and lance-ovate, the wider ones abruptly and rather shortly acuminate, the narrower ones slenderly acuminate, the leaves varying in size up to 2.5×0.7–1.0 mm., decurrent; the branch-leaves ovate to lance-ovate, about 1.7–2.0×0.6–1.0 mm., concave, decurrent, the margin slightly serrulate all around, when dry more or less reflexed at base and the leaves then somewhat plicate; costa thin, reaching about to the middle; median leaf-cells acutely rhomboid or linear-rhomboid, usually about 10–20:1, the apical somewhat shorter, the basal shorter and wider, incrassate especially in the stem-leaves, the alar similar, except that a few are more enlarged, inflated, and oblong-quadrate, but scarcely forming distinct auricles; perichætial leaves up to 2.5 mm. long, slenderly acuminate: seta 2–3 cm. long, rough throughout, drying flattened and twisted, castaneous, sinistrorse except sometimes at the very apex; capsule about 2–3×1 mm., oval-oblong to sub-cylindric, unsymmetric, inclined or more usually nearly horizontal, dorsally gibbous, arcuate, dark-castaneous; lid conic to conic-arcuminate; annulus broad, 2–3-seriate; peristome-teeth slender, castaneous below, the apex hyaline and papillose, basally confluent, the lamellæ and trabeculæ closely placed, teeth dorsally cross-striolate, margined; segments slender, about as long as the teeth, yellowish, carinately split; basal membrane about one-half as high as the segments, some of the cilia usually as long as segments, hyaline, nodose, usually 2 or 3; spores usually minutely roughened, somewhat incrassate, brownish, about .016–.020 mm., maturing in early winter.

On earth, stones, rotten wood, bases of trees, etc., in shady woods and thickets; Europe, Asia, northern Africa, and, in North America, from the Arctic regions to Maryland and Missouri. Rather common in our region.

Allegheny : Panther Hollow, Schenley Park, Pittsburgh, November 25, 1905, Fern Hollow, Pittsburgh, January 21, 1906. O. E. J.; Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J. (Figured).

McKean : Bennett Brook, Bradford, October 18, 1893. D. A. B.

Washington : Hanlin, May 21, 1908. O. E. J.

9. **Brachythecium rivulare** (Bruch) Bryologia Europæa.
(*Hypnum rivulare* Bruch; *B. flavescens* Kindberg).
(Plate LI)

Robust, cespitose in wide and thick mats, pale golden green, shining, rigid: stems hard and woody, prostrate, filiform, leafless when old; branches irregular on the ascending or sub-erect and somewhat dendroid secondary stems which usually reach a height of 3 or 4 cm.; stem-leaves lance-ovate, rather regularly imbricate when dry, erect-spreading or more open when moist, rather distant, broadly ovate, abruptly short-acuminate or acute, concave, decurrent, plicate, denticulate, reaching about 1.8–2.5×1.0–1.4 mm.; branch-leaves similar to the stem-leaves but usually wider, ovate to lance-ovate, decurrent, about 1.5–3×1–1.5 mm., quite concave, dentate above, the margins plane or reflexed below, often somewhat plicate; median leaf-cells linear, about 10–15:1, prosenchymatous with rounded ends, rather incrassate, the apical shorter, the basal abruptly laxer, shorter, wider, the median basal usually with incrassate and porose walls, the alar abruptly differentiated, more or less enlarged, inflated, hyaline to orange-pellucid, forming distinct and widely decurrent auricles; costa often forking, reaching to the middle or above; seta 1.5–2.5 cm. long, strongly papillose throughout, castaneous; capsule castaneous, turgid- to oblong-ovate, about 2–3×1 mm., more or less arcuate, inclined to more or less horizontal; lid conic-acuminate; annulus 2-seriate; exothecial cells at rim small and rounded, below larger and rounded-oblong; peristome-teeth castaneous below, apically hyaline and papillose, basally confluent, strongly trabeculate, distinctly margined by the projecting edges of the cross-striolate dorsal lamellæ; segments nearly as long, carinately split and gaping, yellowish, the basal membrane about one-half as high, cilia 2 or 3, nodose, slender, about as long as the segments; spores smoothish, the walls somewhat incrassate and greenish-brown, about .016–.020 mm., maturing in fall or early winter.

On wet rocks in or at the margin of streams, swamps, or in wet places in ravines, usually where often submerged; Europe, Asia, and from Canada to Missouri and North Carolina. Rather common in our region.

Allegheny	: Moon Township, April, 1902. J. A. S.
Beaver	: Beaver Falls, May 11, 1907. O. E. J.
Cambria	: T. P. James. Cresson. (Porter's Catalogue).
Crawford	: Pymatuning Swamp, near Linesville, May 10-11, 1906. O. E. J. (Figured).
Fayette	: Ohio Pyle, June 14, 1908. O. E. J.

McKean : On stones in running water, Langmade, Bradford, September 11, 1895. D. A. B.
Washington : Hanlin, May 21, 1908. O. E. J.

10. **Brachythecium reflexum** [Starke] Bryologia Europæa. (*Hypnum reflexum* Starke; *H. subtenue* James; *Thuidium laxifolium* Macoun).

Very slender, dark green, densely intertwining to form low, flat patches: the branches short, delicate, often curved, more or less pinnately arranged; stem-leaves cordate-triangular, quickly narrowed to a fine, long, often twisted acumen, strongly decurrent, minutely serrulate all around; branch-leaves narrower, cordate-ovate, strongly decurrent, serrulate all around, smooth to faintly plicate, margins plane to very narrowly recurved, when dry spreading or imbricate and rendering the branches rather julaceous; costa strong, reaching to apex or even into the acumen; leaf-cells short and broad, about 5–8:1, rhomboid-fusiform, sub-obtuse, rather incrassate, towards the basal angles becoming gradually shorter and broader, the alar large, pellucid, rounded-quadrate to rounded-rectangular, not forming very clearly distinct auricles: seta slender, about 1–1.5 cm. long, rough; capsule small, about 2 mm. long, ovate-globose, curved, dorsally turgid, abruptly horizontal; lid convex-conic, apiculate; annulus narrow; cilia slender and appendiculate; spores mature in winter: autoicous.

On rocks and tree-trunks in mountainous or hilly regions; Europe, Asia, and from Arctic America to Missouri and Garrett County, Maryland (J. Donnell Smith). Rare in our region.

McKean : Bradford. D. A. Burnett. (Porter's Catalogue).

11. **Brachythecium starkei** [Bridel] Bryologia Europæa. (*Hypnum starkei* Bridel).

(Plate LI)

Dark green, widely and thinly cespitose, the plants usually quite distinctly complanate: stems slender, creeping, radiculose, pinnate with short, curved-ascending, rather distant, slender branches; branch-leaves loose, divergently spreading, often somewhat secund, those from the middle of the branches broadly ovate to broadly triangular-cordate, abruptly and usually rather shortly slender-acuminate, apically twisted, rarely plicate, strongly and broadly decurrent, marginally serrate above, denticulate below; costa variable but usually about three-fourths as long as the leaf; median leaf-cells about 8–15:1, fusiform-hexagonal to fusiform-rhomboid, sometimes shorter, somewhat incrassate; the basal in one or two rows more or less rectangular-oblong, the alar rather numerous, sub-

rectangular, with thick and often brownish or yellowish walls, forming quite distinct auricles; stem-leaves usually smaller than branch-leaves, proportionally narrower: seta papillose, 3 to 4 cm. long, flexuous, slender, castaneous; capsule small, turgid-oval, often blackish when ripe, the urn about 2.5–3×1 mm., dorsally gibbous, castaneous, abruptly more or less horizontal, sub-globose when empty; annulus large; exothecial cells rounded-quadrate and small at the rim, oblong-rectangular and a little larger below, all strongly castaneous or yellowish and incrassate; peristome-teeth castaneous below, set far back from the edge of rim, margined, rather widely confluent at base, lamellate, cross-striolate dorsally below, hyaline and papillose at apex, strongly trabeculate; segments slender, about as long as teeth, carinately split and often widely gaping in the middle, yellowish; basal membrane about two-fifths as high as the teeth, the cilia 2 or 3, strongly appendiculate, hyaline granular, a little shorter than the segments; spores about .012–.015 mm., greenish-yellow or brownish, slightly roughened, medium-walled, mature in winter.

On moist, rotten wood, stumps, bases of trees, earth, in moist woods in hilly or mountainous regions; Europe, and from Arctic America to northern United States as far south as New Jersey and Pennsylvania. Probably rare in our region.

Elk : Benezette. McMinn. (Porter's Catalogue).

McKean : On shaded banks along Marilla Brook, Bradford, April 25, 1897. D. A. B. (Figured).

12. **Brachythecium velutinum** [Linnæus] Bryologia Europæa. (*Hypnum velutinum* Linnæus; *H. declivum* Mitten).

(Plate LI)

Slender and usually in low, soft, silky mats, bright or yellowish-green, prostrate: stems radiculose; branches numerous, short, in our specimens the branches usually less than 5 mm. long, crowded, irregular or curved, more or less subpinnate; branch-leaves loosely erect-spreading to sub-secund, more widely spreading when dry, lanceolate to lance-ovate, in ours mainly 1–1.5 mm. long, tapering to a long acumination, serrate, apically often twisted, shortly decurrent, faintly plicate, glossy when dry, marginally plane; costa slender, reaching about to the middle; median leaf-cells narrow-linear, rather obtuse, about 8–15:1, the apical similar but a little shorter, the basal shorter, the alar few, rather opaque, incrassate, subquadrate; the stem-leaves similar but usually not so large as some of the branch-leaves; perichætial leaves erect, slenderly acuminate, up to 1.8 mm. long; seta about 1.5 cm. long, very

rough, castaneous, flattened and twisted when dry; capsule about 2–2.5 mm. long, 2–3:1, turgid-oblong, dorsally gibbous to sub-arcuate, castaneous, inclined to horizontally spreading; exothecial cells small and rounded-quadrate at rim, oblong-rectangular below, all densely incrassate; peristome-teeth slender, castaneous and confluent at base, apically hyaline and papillose, dorsally cross-striolate, closely trabeculate and lamellate; segments nearly as long as the teeth, slender, carinately split between the nodes, yellowish, the basal membrane one-third to two-fifths as high; cilia 2 or 3, nodose, hyaline, somewhat shorter than the segments; lid conic-acuminate, about 0.5–0.8 mm. long; annulus large; spores mature in winter, faintly roughened, medium-walled, brownish, .013–.016 mm. in diameter.

On earth, rocks, bases of trees, rotting wood, etc., in rather dry woods, often on knolls; Europe, Asia, and from Arctic America south to New Jersey and Pennsylvania and also in the Pacific States. Thus far reported but once in our region.

McKean : Langmade, near Bradford, April 25, 1898. D. A. B. (Figured).

13. **Brachythecium populeum** (Hedwig) Bryologia Europæa.

(*Hypnum populeum* Hedwig).

Slender, densely cespitose in small yellowish green tufts, lustrous: stems procumbent, branched with numerous, more or less pinnately-arranged, erect or curved-ascending branches; leaves of stem and branches similar except that the branch-leaves are narrower and lanceolate; stem-leaves rather closely imbricated, erect to erect-spreading when dry, ovate-lanceolate, serrate to nearly entire, slenderly and gradually acuminate, non-striate, shortly decurrent; costa strong and nearly reaching the apex; median leaf-cells about 5–8:1, sometimes relatively longer, the basal more or less rectangular, the alar numerous, often yellowish but rather opaque; seta rough except towards the base, where nearly smooth, dark brown; annulus persistent, simple, narrow; capsule cernuous, turgid-ovate to oval, mostly dorsally gibbous, glossy, constricted at the mouth when dry; lid short-acuminate; peristome normal, cilia short, usually 1 or 2 and unequal, appendiculate; spores mature in winter; autoicous.

On roots of trees, stones, sometimes on bases of trees, in shady woods, said to be somewhat partial to pine woods; Europe, northern Africa, and from Nova Scotia to North Carolina and in British Columbia. Rare in our region.

McKean : "*B. populeum rufescens.*" Bradford D. A. B. (Porter's Catalogue).

14. **Brachythecium flagellare** (Hedwig) New Combination.

(*Hypnum flagellare* Hedwig; *Hypnum plumosum* Swartz; *B. plumosum* Bryologia Europæa).

(Plate LII)

Robust in loose, wide, green mats, brownish below: stems prostrate, up to 5 or 6 or more cm. long, with rather densely pinnate branches; the branches stout, ascending to erect, somewhat tumid with the closely imbricate, concave leaves; leaves crowded, erect-spreading when moist, imbricated when dry, often quite strongly falcate-secund, the branch-leaves lanceolate to broadly lance-ovate, abruptly slenderly acuminate, about 1.3–2.0×0.4–0.9 mm., decurrent, serrate above to nearly entire, the base very concave somewhat excavate at the alæ, narrowed, sometimes striate when dry, margin plane or slightly recurved at the base; costa reaching to the middle or a little farther; median leaf-cells narrow to linear, about 8–15:1, the apical shorter, the basal shorter, the median basal enlarged, rounded to oblong, incrassate, sometimes porose, the alar somewhat smaller, oblong to sub-quadrate, incrassate and somewhat opaque; stem-leaves similar, rather scattered, usually smaller and narrower, about 1.5×0.6–0.7 mm., narrowly triangular-ovate; perichætial bracts more or less erect, partly sheathing: seta papillose in the upper half, castaneous, stout, 1.5–2.0 cm. long, sinistrorse below, sometimes dextrorse above; capsule about 1.5–2.5×1 mm., turgidly oval-oblong, blackish when old, dorsally gibbous, horizontal to sub-erect, somewhat unsymmetric; lid conic-acute about 0.6–0.8 mm. long; annulus simple, persistent; peristome-teeth castaneous, confluent at base, strongly trabeculate and lamellate, prominently margined by the projecting lamellæ, dorsally cross-striolate below, hyaline and papillose at apex; segments narrow, carinately split but usually not widely gaping, yellowish, nearly as long as teeth, the basal membrane about one-third as high; cilia 2, nodose, hyaline, sometimes appendiculate below, about as long as the segments; spores smooth, medium-walled, brownish, about .013–.017 mm., mature in autumn.

On rocks in streams, in non-calcareous habitats; Europe, Asia, Hawaiian Islands, and from Newfoundland to British Columbia and south in the mountains to Alabama. Very common in our region.

Allegheny : Fourteen pockets, various localities, various data; Wildwood Road Hollow, November 19, 1908. O. E. J. and G. K. J. (Figured).

Bedford : Along Wills Creek, near Hyndman, October 9, 1904. O. E. J.

Center : Edge of sink-hole pond, Scotia, September 22, 1909. O. E. J.
Fayette : On rocks in edge of Meadow Run, May 30, 1908. O. E. J. and G. K. J.
McKean : Lewis' Run, Bradford, January 24, 1895. D. A. B.
Westmoreland: Garrett Farm, two miles south of Trafford, August 21, 1910. O. E. J.

14*a*. **Brachythecium flagellare** variety **homomallum** (Bryologia Europæa) New Combination.

(*B. plumosum* var. *homomallum* Bryologia Europæa).

(Plate LII)

This variety differs from the type of the species in having the leaves distinctly falcate-secund. It is said to be generally smaller with narrower leaves and with the capsule small and ovate. In the same pockets with typical *B. flagellare* can often be found specimens with characters approaching more or less closely the variety. The following pocket of specimens perhaps typical of the variety:

McKean : Gate's Hollow, Bradford, April 18, 1897. D. A. B. (Figured).

4. *CIRRIPHYLLUM* Grout.

Dioicous: slender to robust, widely cespitose, whitish to yellowish-green, rarely darker, mostly lustrous: stem creeping to ascending, often stolon-like, pinnately to fasciculately branched, often with flagellæ; branches ascending to erect, more or less densely-leaved and julaceous; leaves uniform, often spreading, often drying imbricate, concave, somewhat weakly plicate, ovate to oblong from a somewhat narrowed and decurrent base, more or less abruptly lanceolate to piliferous at the apex, plane-margined, serrate to entire; costa simple, ending at or above the middle of the leaf, never ending in a dorsal spine; median leaf-cells narrowly prosenchymatous, smooth, the basal, shorter, thickened, and porose, the alar more or less numerous, short-rectangular to quadrate, mostly green; inner perichætial leaves from a sheathing base abruptly long and finely acuminate: seta elongate, mostly rough; capsule cernuous to horizontal, oval to oblong-oval, more or less dorsally gibbous, rarely erect and sub-cylindric; annulus present; peristome as in *Brachythecium;* lid usually more or less long-rostrate from a conic base.

A small genus of about 14 species, mostly in temperate regions on rocks and earth: 4 species in North America; 2 species in our region.

Key to the Species.

a. Stems without stolons, almost regularly pinnate; the acumination about one-half as long as the body of the leaf: seta rough. 1. *C. piliferum.*

a. Stems with stolons, irregularly branched; the leaf-acumination short: seta smooth. 2. *C. Boscii.*

1. **Cirriphyllum piliferum** [Schreber] Grout.

(*Hypnum piliferum* Schreber; *Eurhynchium piliferum* Bryologia Europæa).

Robust, in loose straggling patches, glossy yellow-green: stems elongate, up to 10 or 15 cm. long, prostrate, creeping, radiculose, more or less pinnate; the ends of the stems and branches of a paler shining green; leaves concave, widely oblong-ovate, spoon-shaped, abruptly hair-pointed from the rounded apex, the piliferous acumination often reaching one-half the length of the main portion of the leaf, towards the apex of the stems and branches the leaves more closely imbricate and forming cuspidate terete points, but with the piliferous leaf-tips flexuous-spreading, leaf-margin usually slightly denticulate, plane or inflexed; when dry the leaves striate; median leaf-cells about 10–15:1, the basal more lax, shorter and wider, the angular forming a well-defined patch, large, oval-rectangualr; the branch-leaves somewhat smaller, narrower and more gradually pointed; costa broad at base, reaching to about three-fourths the length of the leaf: seta about 2.5 cm. long, rough; capsule oval-oblong to turgid, somewhat arcuate, when dry and empty strongly arcuate and constricted below the mouth, about 2 mm. long; lid conic with a subulate beak about as long as urn, 2 mm.; peristome large, teeth long, the segments about as long, the cilia non-appendiculate, 2 or 3, about as long as the segments; spores mature in fall but capsules rarely found.

In wet woods and swampy meadows, on the ground or on the bases of trees; Europe, and from Greenland to Maryland and Ohio, also from Montana to California. Not common in our region.

Elk : Benezette. McMinn. (Porter's Catalogue).

McKean : D. A. Burnett. (Porter's Catalogue).

2. **Cirriphyllum boscii** (Schwaegrichen) Grout.

(*Hypnum boscii* Schwaegrichen; *Eurynchium Boscii* Jaeger).

(Plate LII)

Loosely cespitose in large, golden-green mats, the older portions blackish, robust: stems up to 8–10 cm. long, prostrate, somewhat pinnately branching, the branches mostly simple, erect, turgid-terete; leaves closely to loosely imbricate, large,

about 1.5–2.5 mm. long, spoon-shaped, abruptly acuminate, the acumination filiform and twisted, the leaves oblong-ovate, scarious, shining; costa double and short, or simple and reaching to the leaf-middle; median leaf-cells narrowly linear-rhomboid, the marginal shorter and mainly rhomboid, the basal short, wide, yellowish-brown, pellucid, irregularly oblong to rectangular, larger but shorter, the alar incrassate, quadrate, forming an indistinct group, the apical shorter and wider than the median, the median about 6–10:1; perichætial leaves narrowly long-acuminate, the inner erect: seta smooth; capsule oblong, about 2.5–3:1, the urn about 2 mm. long, inclined, subarcuate; lid sharply obliquely rostrate, about 1 mm. long; annulus present; peristome normally hypnoid with somewhat split segments and cilia 3, about as long as segments; spores mature in fall.

On earth or rocks in moist woods, often at the edges of the woods, or even in the fields; from New England to Florida and westward to Colorado. Probably fairly common in our region.

Cambria : .....(Porter's Catalogue).
Huntingdon : Pennsylvania Furnace, July 13, 1909. O. E. J.
Washington : Linn and Simonton. (Porter's Catalogue).
Westmoreland: Hillside, May 22, 1909. O. E. J. (Figured).

5. *OXYRHYNCHIUM* (Bryologia Europæa) Warnstorf.

Mostly dioicous: slender to robust, laxly to densely cespitose, dark to yellowish-green, drying soft or stiff, dull to lustrous: stem creeping or ascending, often stolon-like, often bearing rhizoids, irregularly pinnate to fasciculately branched; branches mostly complanate-leaved, stem-leaves and branch-leaves sometimes different, sometimes similar except in size, non-plicate, but little concave; stem-leaves erect-spreading to squarrose, from a somewhat narrowed and sometimes decurrent base ovate to triangularly oval, with short and broad or somewhat longer apex, plane-margined, somewhat serrate; costa simple, ending at or above the leaf-middle, often ending in a dorsal spine; median leaf-cells narrowly prosenchymatous, smooth, the basal shorter, mostly incrassate and porose, the alar differentiated: seta elongated, mostly red, quite thick, mostly rough; capsule cernuous to horizontal, sometimes suberect, thickly oval to oblong-ovate, dorsally gibbous; annulus present; peristome as in *Brachythecium;* lid long and obliquely subulate-rostrate; calyptra glabrous.

A genus of about 30 species, on damp and shaded rocks, stones, or sometimes in water, mostly in temperate regions; 4 species in North America; 2 species in our region.

Key to the Species.

a. Aquatic: alar leaf-cells forming a slightly differentiated group: seta smooth.
1. *O. riparioides.*

a. Terrestrial: alar leaf-cells not differentiated: seta roughly papillose.
2. *O. hians.*

1. **Oxyrhynchium riparioides** [Hedwig] New Combination.
(*Hypnum rusciforme* Necker; *Eurhynchium rusciforme* Milde; *Hypnum riparioides* Hedwig; *Rhynchostegium rusciforme* Bryologia Europæa).

(Plate LIII)

Robust, in large tufts, dark to blackish below: stems prostrate, woody, and usually denuded below; branches suberect or ascending, usually more or less rigid and harsh, especially when dry; leaves ovate, loosely ascending or erect-spreading, scarcely decurrent, about 2–2.5×1–1.5 mm., obtuse to acute, plane-margined, somewhat concave, denticulate nearly to the base; costa thick below, reaching to one-half or two-thirds the length of the leaf, or occasionally even sub-percurrent, often ending in a dorsal spine; median leaf-cells incrassate, linear-fusiform, about 10–12:1, the apical and basal shorter and broader, but no alar group differentiated, the median and upper slightly dorsally spinose: seta smooth, about 1.5 cm. long, castaneous, slightly twisted when dry; capsule castaneous, ovoid-oblong, somewhat constricted below the mouth when dry, about 2–3:1, dorsally turgid but scarcely curved, inclined or nearly horizontal, the urn about 1.5–2 mm. long; lid obliquely slenderly rostrate from a conic base, about two-thirds as long as the urn; annulus revoluble, usually 2-seriate; exothecial cells yellowish-incrassate, at the rim small and rounded-quadrate, below rather large and irregularly oblong-rectangular; peristome-teeth slender, apically hyaline-papillose, strongly trabeculate, dorsally plainly lamellate and finely cross-striolate, margined, confluent at base; segments about as long, usually carinately widely gaping but remaining unsplit at apex, the basal membrane about one-half as high; cilia 2–3, subulate, nodose to sub-appendiculate, somewhat shorter than the segments; spores weakly papillose, medium-walled, yellowish, about .010–.013 mm., mature in early fall.

On rocks in streams and rivulets; Europe, Asia, northern Africa, and from Newfoundland to Ontario and southwards in the mountains to Georgia. Quite common in our region.

Cambria : Cresson. T. P. James. (Porter's Catalogue).

Center : In rapidly flowing mountain-stream, Tussey's Mt., above Shingletown, July 15, 1909. O. E. J.

Lawrence : In rivulet, bottom of Conoquennessing Gorge, near Rock Point, October 15, 1910. O. E. J. and G. K. J.

McKean : On stones in running water, Boss Branch, October 20, 1893, Bolivar Run, August 25, 1895, Lewis' Run, November 24, 1895, and Bennett Brook, November 2, 1896, all near Bradford. D. A. B.

Westmoreland: On submerged stones in Tub-Mill Run and on gravelly bottom of mountain spring, Mellon's estate, Rachelwood, Laurel Hill Mountain, September 8-11, 1907. O. E. J. (Figured).

2. **Oxyrhynchium hians** (Hedwig) New Combination.

(*Hypnum hians* Hedwig; *Eurynchium hians* Jaeger and Sauerbeck; *Hypnum praelongum* C. Mueller; *Pterygynandrum apiculatum* Bridel).

(Plate LIII)

Rather slender, depressed, cespitose, somewhat shining: stems creeping, rather sparsely branched, slender, usually not over 3 or 4 cm. long, the branches short and more or less distichously arranged; leaves of the stem and longer branches rather distant, on some of the short branches sometimes more or less imbricated-julaceous, the stem-leaves about 1–1.6 mm. long by three-fourths as wide, concave, ovate, the apex abruptly acute to shortly acuminate, the base clasping but not decurrent, margins sharply serrulate nearly to the base; branch-leaves closely similar; costa distinct, reaching to one-half to four-fifths the length of the leaf; median cells about 5–8:1, prosenchymatous, medium-walled, the apical rhomboid, shorter, about 2–4:1, the basal shorter and incrassate, the alar forming an indistinct group of thick-walled quadrate to rectangular cells; perichætial leaves up to 2 mm. long, ovate-oblong, sheathing, acuminate, serrate above: seta dark-castaneous, stout, strongly papillose, 1–1.5 cm. long; capsule inclined to horizontal, arcuately oblong-cylindric, narrowed below the rim but slightly when dry, the urn about 2 mm. long by 1 mm. thick, castaneous; operculum conic and slenderly rostrate, yellowish, about 1 mm. long; exothecial cells yellowish-incrassate, at the rim rounded-quadrate in about two series, below larger oblong-rectangular; annulus narrow, 2-seriate; peristome-teeth castaneous, slender, hyaline-papillose at apex, strongly trabeculate, narrowly margined, the dorsal lamellæ often in three series towards the base, striolate in various directions; segments about as long as teeth, slender, narrowly carinately gaping between nodes, the basal membrane about

two-fifths as high as teeth, the cilia usually two, slender, nodose to shortly appendiculate, nearly as long as segments; spores papillose, yellowish, medium-walled, about .011–.015 mm. in diameter, mature in late fall or early winter.

On the ground in moist, shady places in woods, etc, in Europe, Asia, and in North America from Nova Scotia to British Columbia south to the Gulf States. Apparently not common in our region.

Fayette : Ohio Pyle, September 1-3, 1906. O. E. J. and G. K. J.

McKean : On shaded banks of rivulet, Bennett Brook, April 9, 1893, Marilla Brook, September 29, 1894 (Figured), and on ground over leaf-mold, April 19, 1897. All near Bradfrod. D. A. B.

6. *EURYNCHIUM* Bryologia Europæa.

Dioicous and pseudoautoicous: slender to robust, laxly or densely cespitose, green to yellowish, drying stiff and more or less lustrous: stem creeping to ascending, often more or less stolon-like, here and there fasciculate, often bearing flagellæ, pinnate to fasciculate or even dendroid; branches more or less densely-leaved; leaves often dimorphic, mostly plicate; stem-leaves spreading to squarrose, more or less concave, ovate-cordate to triangular-cordate from a narrowed and more or less decurrent base, margins plane, serrate, the apex short and broad to long and narrow; costa simple, more or elss elongate, often ending as a dorsal spine; median leaf-cells smooth, prosenchymatous, narrow, at base shorter and usually incrassate and porose, the alar differentiated; inner perichætial leaves with squarrose-reflexed, subulate tips: seta mostly smooth; capsule sernuous, sometimes horizontal, ovate to sub-cylindric, more or less dorsally gibbous; peristome as in *Brachythecium;* lid long and finely rostrate; calyptra glabrous.

A genus of about 16 species, on rocks, earth, or bark, almost entirely in temperate regions; about 6 species in North America; probably only one species in our region.

1. **Eurynchium pulchellum** (Hedwig) New Combination.

(*Hypnum pulchellum* Hedwig; *H. strigosum* Hoffmann; *Eurhynchium strigosum* Bryologia Europæa).

So far as known this species is represented in our region only by the following variety, which differs from the typical species in the larger leaves and sporogonia and the more robust habit.

1*a*. **Eurynchium pulchellum** variety **robustum** (Roell) New Combination.

(*E. strigosum* var. *robustum* Roell; *Hypnum strigosum* Drummond).

(Plate LIII)

Loosely matted or densely tufted, bright and shining green: stems stoloniferous, creeping, with distant leaves; secondary stems prostrate to erect, often curved, rather robust; leaves on the middle of the branches erect-spreading, lance-ovate, scarcely decurrent, reaching about 1–1.2×0.4–0.5 mm., acute to widely obtuse, plane-margined, sharply serrate above, concave, scarcely plicate, costate to about two-thirds, the costa usually ending in a dorsal spine; median leaf-cells about 8–10:1, linear to linear-rhomboid, the apical becoming rhomboid-oblong and about 2–3:1, the basal somewhat shorter than the median, the alar few, rectangular to quadrate or oval; stem-leaves decurrent, rather long-acuminate from an ovate to triangular-ovate base, somewhat larger than the branch-leaves, reaching about 1.2–1.5 mm. long, serrate nearly to the base, costate to about two-thirds; paraphyllia small, rounded-ovate; leaves on the stolons ecostate, triangular-ovate, small, acuminate: seta castaneous, smooth, about 1–1.5 cm. long, drying dextrorse above; capsule yellowish-brown, oblong-ovate, about 2–3:1, more or less dorsally turgid or sub-arcuate, drying slightly constricted below the mouth, inclined or almost horizontal, the urn about 2 mm. long; annulus 2–3-seriate; lid convex, slenderly rostrate, about 1.5 mm. long; exothecial cells rounded-quadrate at rim, oblong-hexagonal to rectangular below, incrassate; peristome-teeth hyaline and papillose at apex, below dorsally cross-striolate, margined, plainly lamellate, strongly trabeculate, confluent at base; segments narrow, nearly as long as the teeth, carinately split between the nodes, yellowish, the basal membrane about two-fifths as high; cilia 3, slender, hyaline, nodose, usually one or two of them nearly as long as the segments; spores yellowish, incrassate, papillose, about .012–.014 mm., mature in autumn.

The species occurs on gravelly or sandy soil, rocks, roots of trees, etc., in open woods in Europe, Asia, northern Africa, and from Arctic America to northern United States. The variety **robustum** occurs in north central United States and rather commonly in the northern portion of our region.

Elk : McMinn. (Porter's Catalogue).

McKean : Six pockets of specimens collected on the ground or on rocks in woods, near Bradford, May 13, 1893, to September 29, 1896. (Figured). D. A. B.

7. *BRYHNIA* Kaurin.

Dioicous: more or less slender, weak, widely and laxly cespitose, more or less dark green, when old yellowish or brownish, rather dull: stem elongate, procumbent, rhizoids fascicled, branching interruptedly pinnate, some of the shoots in the middle of the tufts often erect and tree-like but later procumbent and giving rise to new shoots; branches usually spreading to recurved, thin, acute, mostly laxly-leaved; paraphyllia none; stem-leaves loosely imbricate, more or less concave, irregularly plicate, triangular-cordate to lance-ovate from a widely decurrent and non-auriculate base; shortly or more slenderly pointed, plane-margined, finely serrate all around; costa simple, ending in or over the leaf-middle, smooth; median leaf-cells incrassate, green, oblong-rhomboid to oblong-hexagonal, the basal lax, a few alar rectangular; branch-leaves mostly dorsally rough by projecting cell-angles, sharply serrate all around; costa often ending dorsally in a spine; inner perichætial leaves oblong, abruptly narrowed to a reflexed-squarrose, long, serrate acumination: seta 8–15 mm., dark red, very rough; capsule cernuous to horizontal, dorsally gibbous, oval, to oblong-cylindric; annulus present; peristomes of equal length, the teeth basally confluent, dorsally cross-striate, normally lamellate, apically papillose; inner peristome yellow, finely papillose, basal membrane high, segments lanceolate, long-subulate, split and finally gaping along the keel, cilia well-developed; lid more or less plainly shortly and thickly rostrate from a conic base; calyptra glabrous.

A small genus of 5 species, occurring on various substrata, confined to the Northern Hemisphere; 3 species in North America; 2 species in our region.

Key to the Species.

a. Branch-leaves acute to short-pointed, the apex mostly twisted.
1. *B. novae-angliae.*

a. Branch-leaves acuminate, the apex not twisted.
2. *B. graminicolor.*

1. **Bryhnia novae-angliae** (Sullivant and Lesquereux) Grout.

(*Hypnum novae-angliae* Sullivant and Lesquereux; *Brachythecium novae-angliae* Jaeger and Sauerbeck).

Widely and loosely matted, bright green outside, dirty green inside, rigid: stems prostrate, irregularly sub-pinnately branched, sometimes more or less dendroidal in appearance; branches often quite distinctly julaceous; branch-leaves rather loosely imbricate when dry, erect-spreading when moist, ovate, acuminate, concave, decurrent, serrulate, up to 1–1.2× 0.5–0.6 mm., dorsally papillose by reason of the projecting cell-

angles, the leaf-apex often twisted about half-around to the right, (sinistrorse); median leaf-cells about 5–6:1, oblong-hexagonal, somewhat shorter and broader below and at the basal angles; perichætial leaves ovate, abruptly long-acuminate, faintly costate; costa of branch- and stem-leaves reaching about to the middle; stem-leaves similar to the branch-leaves: seta short, very rough, dark castaneous; capsule dark-castaneous, blackish when old, about 4–5:1, reaching about 3.5 mm. in length, oblong, erect, slightly curved; lid conic-acuminate; peristome normal; annulus double, large; spores mature in winter.

On the ground and on stones in swamps and wet, shady places; Europe, Asia, and from Canada to Missouri and North Carolina. Rather uncommon in our region.

Butler : On swampy soil, Crider's Corners, December 29, 1908. O. E. J.

McKean : Bradford. D. A. Burnett. (Porter's Catalogue).

2. **Bryhnia graminicolor** [Bridel] Grout.

(*Hypnum graminicolor* Bridel; *H. sullivantii* Spruce; *Eurhynchium graminicolor* Paris).

(Plate LIV)

Small, much more slender than the preceding species, densely to loosely cespitose, pale green, yellowish below: stems slender, red, usually not over 1–2 cm. long, rather irregularly branched with erect branches; branch-leaves reaching about 0.8×0.2–0.3 mm., narrowly lance-ovate, long-acuminate, concave, serrulate to the base, marginally reflexed below, the base scarcely decurrent, the back strongly papillose by reason of the projecting cell-angles, the costa reaching to above the middle; stem-leaves larger, up to 0.8–1.0×0.4–0.5 mm., with a somewhat more slender acumen; median leaf-cells linear-flexuous, incrassate, varying from 8–20:1, minute, obtuse, the alar sub-quadrate, thin-walled, pellucid; perichætial leaves oblong, basally sheathing, filiform-acuminate, very faintly costate: seta about 1 cm. long, rough throughout; capsule oval to oblong or turgid-ovate, dorsally somewhat gibbous about 2–3:1, inclined, about 2–2.5 mm. long; annulus simple persistent; lid conic to short-rostrate; peristome normally hypnoid, segments as long as the teeth, carinately split, the cilia 2, somewhat shorter; rather uncommon, capsules rarely produced.

In moist woods and shady places on rocks or earth; from New Brunswick to Minnesota and south to Georgia. Rare in our region.

Huntingdon : Alexandria. T. C. Porter (Porter's Catalogue.

McKean : Bolivar and Bennett divide on shaded dripping rocks, April 21, 1895 (Figured), and on perpendicular faces of rocks, Lewis' Run, April 25, 1895. D. A. B.

8. *RHYNCHOSTEGIUM* Bryologia Europæa.

Autoicous: more or less robust to quite slender, mostly soft, cespitose, pale green to dark green, rarely yellowish to golden-brown, more or less lustrous: stem creeping, bearing rhizoids, sometimes stolon-like, irregularly to pinnately branched; branches more or less thickly-leaved, often complanate; leaves spreading, rarely imbricate, shortly or non-decurrent, mostly a little concave, non-plicate, ovate to lance-ovate from a narrowed base, with a short or long point, mostly serrulate, the margin basally reflexed; costa simple or rarely forked, ending in about the middle of the leaf; median leaf-cells mostly narrowly prosenchymatous, smooth, the basal shorter and wider, the alar not differentiated, sometimes short-rectangular or quadrate; inner perichætial leaves sheathing, abruptly subulate and reflexed from the middle: seta more or less elongate, smooth; capsule cernuous to horizontal, oval and weakly gibbous dorsally to oblong or oblong-cylindric and almost symmetric, often constricted below the mouth when dry and empty; annulus present; peristome as in *Brachythecium;* lid long-rostrate from a convex-conic base; calyptra-glabrous.

About 115 species, occurring on earth and stones, mostly in the temperate and sub-tropic regions; about 8 species in North America; probably only the following in our region:

1. **Rhynchostegium serrulatum** (Hedwig) Jaeger.

(*Hypnum serrulatum* Hedwig).

(Plate LIV)

Loosely matted, bright yellowish-green, when dry sub-lustrous: stems creeping, sub-pinnately branched with long and more or less 2-ranked branches; branch-leaves complanate, 1.5–2 mm. long, thin, concave, ovate-lanceolate, acuminate, serrulate from usually below the middle, thinly-costate to the middle or beyond, the apex often twisted, the margin plane and not bordered; perichætial leaves similar but more oblong; stem-leaves similar but relatively wider and more cordate; median leaf-cells linear, prosenchymatous, about 8–10:1, at base somewhat broader and shorter, the alar not differentiated: seta about 2.5 cm. long, smooth, castaneous, sinistrorse when dry; capsule light yellow to dark castaneous,

oblong, cernuous, incurved, when dry contracted below the mouth; lid conic, slenderly rostrate, the beak long and recurved; peristome-segments nearly as long as teeth, cilia usually 3, about as long as segments, nodose to weakly appendiculate; basal membrane reaching almost to middle of inner peristome; teeth narrowly lanceolate, yellowish-brown, with distinct divisural, moderately trabeculate; annulus large; exothecial cells rectangular to hexagonal, yellowish-incrassate, or brownish; spores yellowish-incrassate, finely papillose, about .009–.012 mm. in diameter, mature in September and October.

In shaded woods on leaf-humus, old logs, etc., from Newfoundland to the Gulf States and west to the Mississippi River, also in British Columbia and Alaska. Very common in our region.

Allegheny	: Forty pockets representing collections from almost all sections of the county, various data. Figured from specimens from Darlington Hollow, Aspinwall, October 25, 1908. O. E. J.
Armstrong	: Kittanning, September 24, 1904, and October 21, 1905. O. E. J.; Buttermilk Falls, August 22, 1903. D. R. Sumstine.
Beaver	: T. P. James. (Porter's Catalogue).
Butler	: Swampy woods near Crider's Corners, December 29, 1908. O. E. J.
Fayette	: Eleven pockets, Ohio Pyle, various dates, O. E. J., and O. E. J. and G. K. J.; Cheat Haven, September 3-6, 1910. O. E. J. and G. K. J.
Washington	: Charleroi, October 13, 1905. O. E. J. and G. E. K.
Westmoreland	: Mellon's estate (Rachelwood), Laurel Hill Mountain, September 8-11, 1907. O. E. J.; Chestnut Ridge above Hillside, September 16-17, 1909, and "Shades," near Blackburn, March 25, 1910. O. E. J. and G. K. J.
Cambria	: Cresson. T. P. James. (Porter's Catalogue).
McKean	: Quintuple, January 17, 1894. D. A. B.

GLOSSARY OF BRYOLOGICAL TERMS USED IN THE MANUAL

Acaulescent, stemless.
Acrocarpous, with the fruit terminal on the stem or branch.
Acumen, a slenderly tapering apex,—acumination.
Acuminate, narrowly and slenderly tapering at the apex.

Acute, rather abruptly sharply pointed.
Alar, applied to the cells at the basal angles of the leaf.
Angular, applied to the alar group of cells.
Annulus, the ring of specialized cells often occurring between the rim of the capsule and the operculum.
Antheridium, the male reproductive organ. See Introduction.
Apiculate, ending in a sharp and short point or apiculus.
Apophysis, the hypophysis or swelling of the seta just below the capsule.
Appendiculate, with reference to the cilia, with short transverse bars.
Archegonium, the more or less flask-shaped female organ.
Arcuate, bent like a bow.
Areolation, the cellular mesh or network of the leaf.
Aristate, awn-like or bristle-like.
Articulate, jointed, or with cross-bars.
Attenuate, long drawn out.
Auriculate, furnished with more or less ear-like lobes at the basal angles, applied to the leaf.
Autoicous, having the archegonia and antheridia in separate clusters on the same plant.
Axillary, situated in the axil or upper angle of the insertion of a leaf.
Beak, the prolonged narrow apex of the operculum.
Bicostate, having a double costa or midrib.
Bifid, two-cleft.
Bifurcate, forked.
Bi-stratose, with two layers of cells.
Bi-striate, with two parallel lines or striæ.
Calyptra, the thin and usually more or less membraneous hood or cap on top of the capsule.
Campanulate, bell-shaped.
Canaliculate, channeled.
Cancellate, (teeth) lattice-like.
Capsule, the spore-case or so-called "fruit" of a moss.
Carinate, keeled.
Caulescent, furnished with a stem.
Castaneous, chestnut-brown in color.
Central Strand, a central bundle of narrow and elongated cells found in some moss-stems.
Cernuous, somewhat drooping, nodding.
Cespitose, forming mats or tufts.
Chlorophyllose, containing chlorophyll or the green coloring matter of leaves.
Cilia, fine hair-like processes, usually applied to the hair-like structures often occurring between the peristome-segments.
Circinate, coiled inward from the apex.

Cirrate, curling up in drying.
Clavate, club-shaped.
Cleistocarpous, applied to a capsule which bursts open irregularly.
Collum, the more or less tapering neck or base of the capsule.
Columella, the central axis of the capsule around which the spores are produced.
Comose, tufted at the apex, in a coma.
Complanate, flattened.
Confluent, merging together.
Constricted, contracted somewhere below the top or apex.
Cordate, heart-shaped.
Cortex, the outer bark or specialized layer.
Cortical, referring to the cortex.
Costa, the midrib or mid-vein of the leaf.
Crenate, with rounded teeth.
Cribrose, perforated more or less sieve-like.
Crispate, variously curled and bent.
Cucullate, hood-like.
Cuneate, wedge-shaped.
Cuspidate, tipped with a sharp and rigid point.
Cuticular, belonging to the outermost skin.
Cygneous, abruptly down-curved like a swan's neck.
Cymbiform, the whole leaf more or less boat-shaped.
Decumbent, reclining but with the apex ascending.
Decurrent, (leaves) with the borders extending down the stem below the insertion.
Dehiscent, splitting open.
Dendroid, tree-like in form.
Dentate, toothed with outwardly directed teeth.
Denticulate, minutely toothed.
Deoperculate, (capsule) with the lid fallen off.
Dextrorse, twisted to the right as the threads of the ordinary screw or bolt, used in the opposite sense by some authors.
Dimidiate, split on one side.
Dimorphous, with two forms.
Dioicous, with the antheridia and archegonia on separate plants.
Discoid, disk-shaped as in some male inflorescences.
Distichous, in two opposite rows, two-ranked.
Divaricate, widely diverging or spreading.
Divisural (Line), the median line running up and down the teeth of the peristome and often zigzag.
Ducts, applid to the narrow chlorophyllose cells in the leaves of the Sphagnums.
Ecostate, without a costa.
Emarginate, apically notched.
Emergent, applied to capsules rising slightly above the perichætial leaves.

Exannulate, with no annulus.
Erose, irregularly notched.
Excavate, applied to leaf-insertions hollowed out in a more or less definite curve.
Excurrent, with the costa extending beyond the apex of the leaf.
Exothecial, the outer layer of cells of the capsule-wall.
Exserted, projecting beyond, as a capsule rising beyond the perichætial leaves.
Falcate, scythe-shaped, flat, gradually tapering and curved.
Falcate-secund, falcate and turned to one side of the stem.
Fasciculate, in close and usually short clusters; usually applied to short, unequal, lateral, bunched branches.
Fastigiate, with branches erect, near together, and more or less equal in height.
Fibrillose, applied to hyaline cells of *Sphagnum* in which the walls are lined with fine fibrils or filaments.
Filiform, thread-like.
Fimbriate, fringed.
Flagelliform, lash-like or whip-like.
Flexuose, wavy or bending alternately back and forward.
Frondose, bearing fronds, or frond-like.
Fugacious, falling away very early.
Fusiform, spindle-shaped.
Gametophyte, the sexual stage in the life-history of the moss and resulting from the germination of a spore. Usually begins with a filamentous protonema which eventually gives rise to leafy stems, which finally bear the sexual organs (archegonia and antheridia) and, upon the fertilization of the archegonium, there is produced the other alternating phase, the sporophyte.
Gemmae, small more or less bud-like bodies capable of reproducing the plant.
Gemmiparous, producing gemmæ.
Geniculate, bent like a knee.
Gibbous, swollen on one side.
Glabrous, with a smooth surface.
Glaucous, covered or whitened with a bloom.
Granulose, finely roughened as with grains of sand.
Gregarious, growing near together or in groups but not forming tufts or mats.
Gymnostomous, with the mouth of the capsule devoid of peristome.
Hamate, hooked.
Heteroicous, with two or more forms of inflorescence in the same cluster.
Hispid, beset with stiff hairs.
Hispidulous, minutely hispid.

Homomallous, (leaves) bent or curved to one side, all in the same direction.
Hyaline, transparent and colorless like water.
Hygroscopic, altering form or position with changes in moisture.
Imbricated, overlapped like the shingles on a roof.
Immersed, (capsule) concealed within the leaves of the perichætium.
Incrassate, thickened, or thick-walled (cells).
Indehiscent, not splitting open.
Inflorescence, the clusters of reproductive organs, usually with enclosing bracts.
Innovation, a young offshoot from the stem.
Insertion, the point of attachment of the leaf to the stem or branch.
Involucre, a whorl of leaves or bracts around the flower.
Julaceous, worm-like or catkin-like.
Laciniate, deeply slashed or cut into narrow lobes.
Lamellae, thin plates, particularly the flat plates on the dorsal surface of many peristome-teeth; also on ventral surface of many leaves.
Lamina, the leaf-blade.
Lanceolate, lance-shaped.
Lid, the covering of the mouth of the capsule, the operculum.
Ligulate, strap-shaped.
Linear, long and narrow with parallel sides.
Lingulate, tongue-shaped.
Lumen, the cavity of a cell.
Mamillate, tipped with a nipple-shaped projection.
Margin, (of a leaf) a bordering band of peculiar shape or color.
Mitriform, mitre-shaped, or like a peaked cap, symmetric.
Monoicous, with the antheridia and archegonia on the same plant.
Mucronate, with the costa percurrent as a short small abrupt tip, tipped with a mucro.
Muricate, with the surface roughened with short, hard points.
Muticous, not pointed.
Neck, the collum.
Nodose, (cilia) with knots or swollen articulations.
Ob-, a prefix often used to convey the sense of inversion.
Obconic, inversely conic.
Obcordate, inversely cordate.
Obovate, inversely ovate, narrowed towards the base.
Obsolete, scarcely apparent.
Operculum, the lid covering the mouth of the capsule.
Ovate, more or less egg-shaped, with the broader end downward.
Ovoid, more usually applied to a solid with an egg-like outline.
Panduriform, fiddle-shaped.
Papillae, minute nipple-shaped protuberances.

Papillose or *Papillate,* covered with papillæ.

Paraphyllia, minute thin leaves or branched organs scattered among the leaves.

Paraphyses, jointed and hyaline hair-like structures growing among the reproductive organs.

Parenchymatous, composed of broad cells joined end-to-end with square ends, not dove-tailed.

Paroicous, having the antheridia and archegonia in the same cluster but not mixed, the antheridia being in the axils of the perichætial leaves below the archegonia.

Patent, spreading.

Pectinate, branched or divided like a comb.

Pedicel, the seta or stalk of the capsule.

Pedicellate, furnished with a pedicel.

Pellucid, translucent but scarcely hyaline.

Pendulous, drooping rather more than when cernuous, hanging down.

Percurrent, (costa) running through the whole length of the leaf.

Perichætium, the involucre or whorl of bracts around the female flower and thus also around the base of the seta or sessile capsule.

Perigonium, the whorl of bracts around the male or antheridial flower.

Peristome, the fringe of teeth, etc., at the mouth of the capsule.

Persistent, not easily nor early deciduous.

Pinnate, with the branches more or less equidistant and arranged on both sides of the stem like a feather.

Piliferous, bearing a hair-like prolongation.

Plane, flat.

Pleurocarpous, with the flowers more or less axillary and the fruit laterally borne.

Plicate, folded longitudinally.

Plumose, plume-like.

Pluriseriate, arranged in several or many series, as of leaves on the stem.

Polygamous, with the antheridia and archegonia variously disposed on the same plant.

Porose, pierced with small holes or pores.

Procumbent, trailing along on the ground.

Proliferous, bearing abnormal shoots, often from the flower cluster.

Prosenchymatous, composed of narrow cells whose ends dove-tail past each other, as opposed to the square-ended parenchymatous cells.

Protonema, the green filamentous phase of the gametophyte which is derived directly from the germination of the spore, and sometimes persisting.

Pseudopodium, in *Sphagnum* the false seta bearing the capsule; in *Aulacomnium,* etc., a leafless seta-like branch bearing gemmæ.

Punctate, marked with dots.

Pyriform, pear-shaped.

Quadrate, square.

Radicles, rootlets or rhizoids growing out from the base of the stem.

Radiculose, covered with radicles.

Ramose, branching.

Ramulose, bearing smaller branchlets.

Repand, undulately or wavy-margined.

Reticulate, in the form of a net-work.

Retort Cells, cuticular cells of *Sphagnum* having an outward-curved apex.

Retuse, with the obtuse apex slightly indented.

Revolute, rolled backward from the margin.

Revoluble, curling off, as does the annulus of many mosses.

Rhomboid, diamond-shaped.

Rostellate, short-beaked.

Rostrate, with a more or less long beak.

Rugose, wrinkled.

Rupestral, inhabiting rocks.

Scabrous, rough.

Scarious, thin, dry, membraneous, but not green.

Secund, turned to one side.

Segments, the main divisions of the inner peristome.

Serrate, with forward-projecting teeth.

Serrulate, minutely serrate.

Sessile, not stalked.

Seta, the stalk or pedicel bearing the capsule.

Setaceous, bristle-like.

Sheathing, applied to perichætial leaves which wrap around the seta or ordinary leaves wrapping around the stem.

Sinistrorse, twisted to the left, as is the case with the threads of the rather-rare "left-handed" screw or bolt. By some authors used in the opposite sense.

Sinuose, wavy.

Spatulate, spatula-like, bluntly and narrowly obovate and quite attenuate downwards.

Spinulose, furnished with small spines.

Sporangium, usually synonymous with capsule.

Sporophyte, the spore-bearing generation of the moss arising from the fertilization of the archegonium and known also as the sporogonium,—usually consisting of foot, seta, and capsule.

Squarrose, spreading abruptly and widely.

Squarrulose, a lesser degree of squarrose.
Stegocarpous, with the capsule operculate.
Stipitate, mounted on a short stalk.
Stoloniferous, bearing slender, creeping and usually minutely-leaved secondary stems or branches.
Stomata, breathing pores, or openings, in the epidermis.
Stomatose, bearing stomata.
Striate, marked with fine longitudinal lines or ridges.
Striolate, being very finely striate.
Strumose, furnished with a struma or unsymmetrical swelling at the base of the capsule, goitre-like.
Sub-, as a prefix commonly used to denote the idea of somewhat or slightly.
Subulate, awl-like.
Sulcate, longitudinally grooved.
Synoicous, with the antheridia and archegonia mixed together in the same flower.
Terete, cylindrical or tapering.
Terrestrial, growing on earth.
Tessellate, checkered.
Tomentose, covered with soft matted hairs or tomentum.
Trabeculae, the more or less projecting plates on the inner side of the peristome-teeth.
Trabeculate, furnished with trabeculæ.
Truncate, with the apical portion more or less squarely cut off.
Tubulose, tube-like.
Tumid, swollen, turgid.
Turbinate, top-shaped.
Turgid, more or less rigidly swollen as from internal pressure, tumid.
Umbonate, with a slight projection in the center like the boss of a shield.
Uncinate, hook-shaped.
Unilateral, one-sided.
Unistratose, (cells) in one layer.
Urceolate, urn-like, contracted at or below the mouth.
Utricles, applied to the large hyaline cells of the leaves of *Sphagnum.*
Vaginate, surrounded by a sheath.
Vaginule, a small sheath, the modified remains of the lower part of the archegonium surrounding the base of the seta.
Ventral, the surface of the leaf facing the stem, as ordinarily situated.
Ventricose, bulging on one side.
Vermicular, worm-shaped.

Verrucose, minutely warty.
Verticil, a whorl.
Verticillate, whorled.
Vesiculose, more or less bladdery, like inflated air-spaces, vesicular.
Villous, covered with long, soft hairs.

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PLATES

Explanation of Method of Lettering.

To facilitate reference and comparison of the various plates a series of letters and figures has been used which applies uniformly to all of the plates alike.

a, Apex
an, Annulus
B, Branch
b, Base
bc, Basal median
c, Central or median
cr, Cross-section
ci, Cilia
d, Dorsal
g, Gemmæ
lm, Lower margin
m, Margin.
o, Lid or operculum
P, Habit sketch of plant, or of a portion of a plant
sp, Spores
S, Stem
s, Peristome-segments
t, Teeth
upm, Upper margin
v, Ventral

1, Stem-leaf
2, Branch-leaf
3, Perichætial leaf
4, Paraphyllia
5, Seta
6, Capsule
7, Calyptra
8, Peristome

The various letters and figures are used in combination as follows: 1*a*, apex of stem-leaf; 1*bc*, median basal portion of stem-leaf; 2*bc*, median basal portion of branch-leaf; 2*ad*, dorsal view of apex of branch-leaf; 3*upm*, upper margin of perichætial leaf, etc.

PLATE I

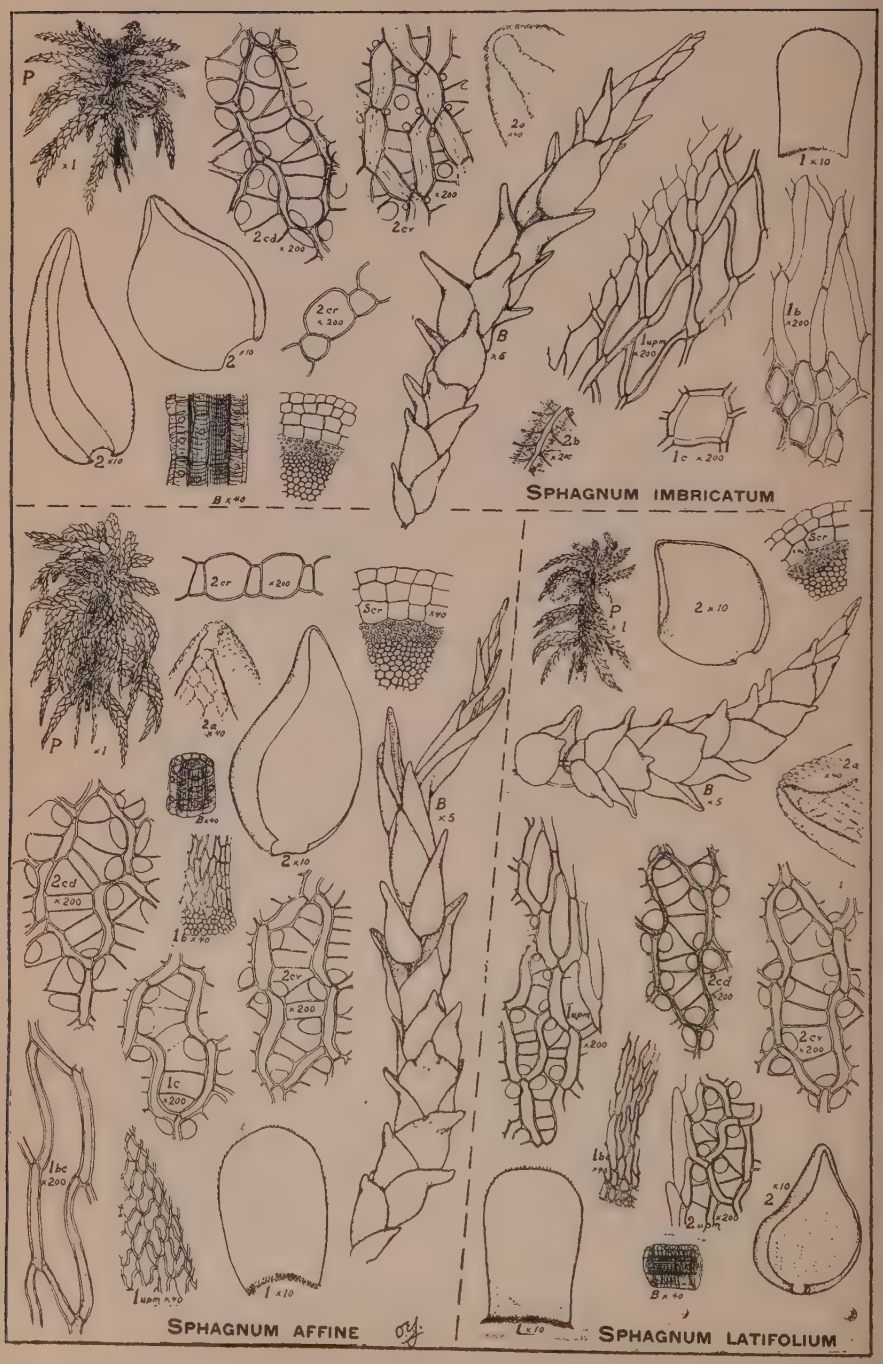

SPHAGNUM IMBRICATUM
SPHAGNUM AFFINE
SPHAGNUM LATIFOLIUM

PLATE II

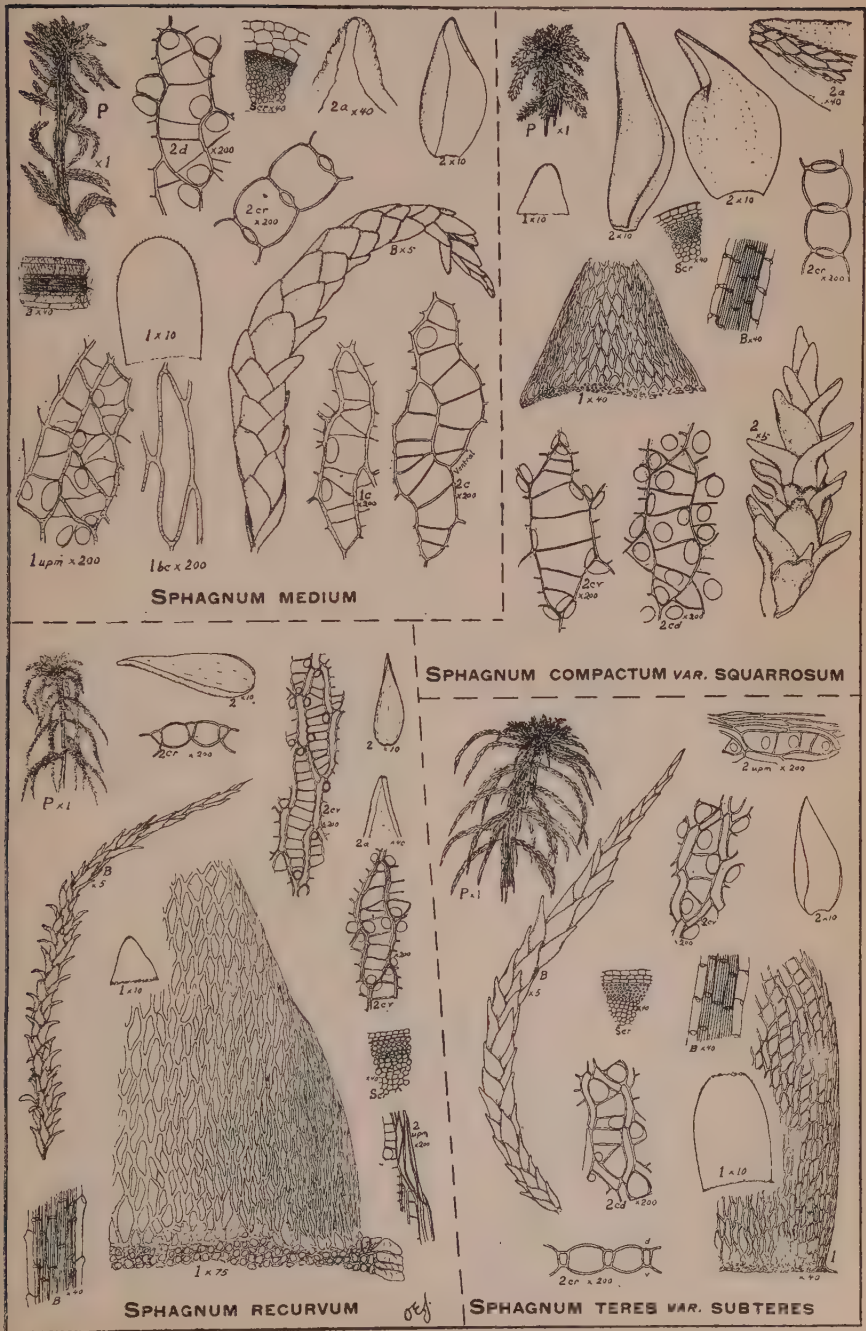

SPHAGNUM MEDIUM
SPHAGNUM COMPACTUM VAR. SQUARROSUM
SPHAGNUM RECURVUM
SPHAGNUM TERES VAR. SUBTERES

PLATE III

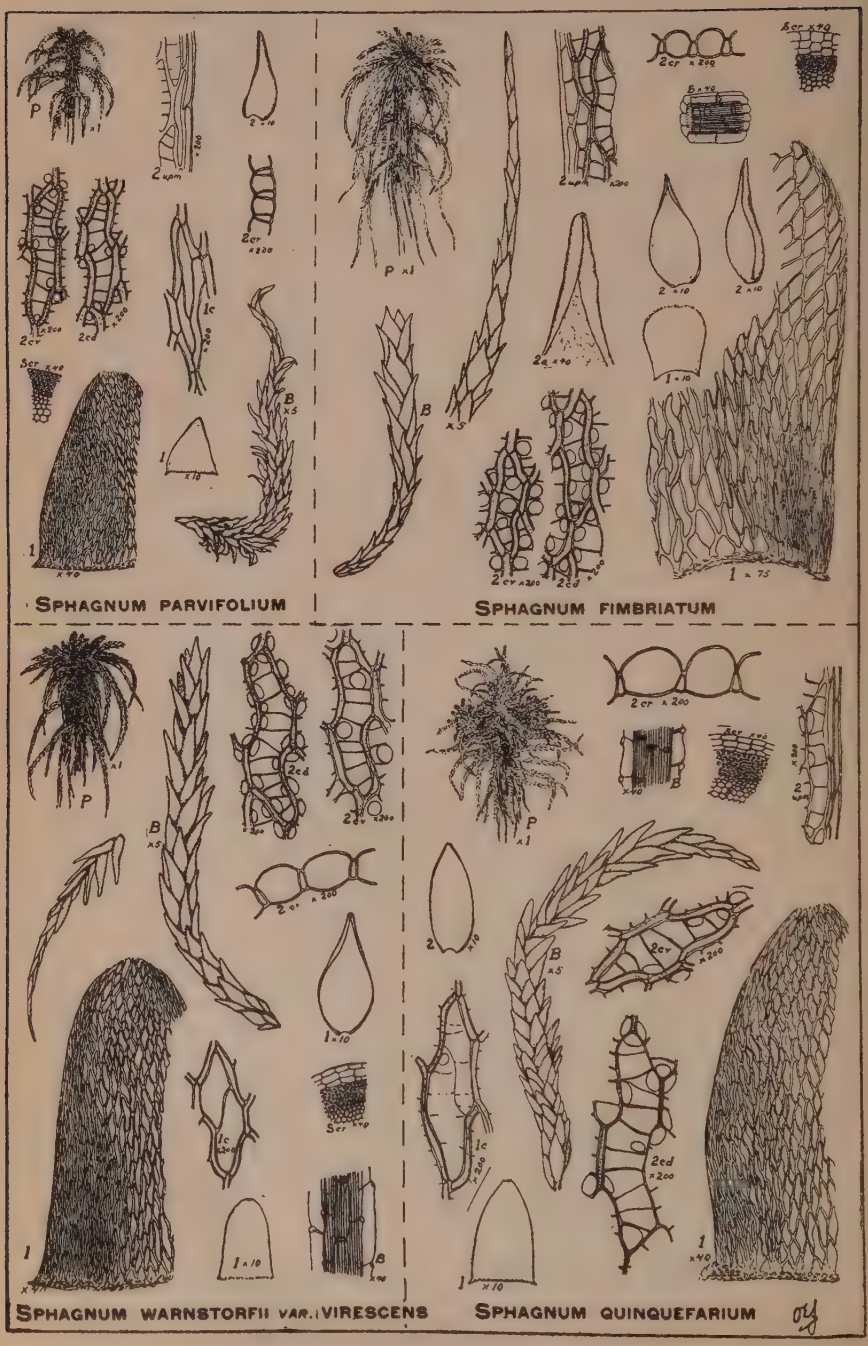

SPHAGNUM PARVIFOLIUM
SPHAGNUM FIMBRIATUM
SPHAGNUM WARNSTORFII VAR. VIRESCENS
SPHAGNUM QUINQUEFARIUM

PLATE IV

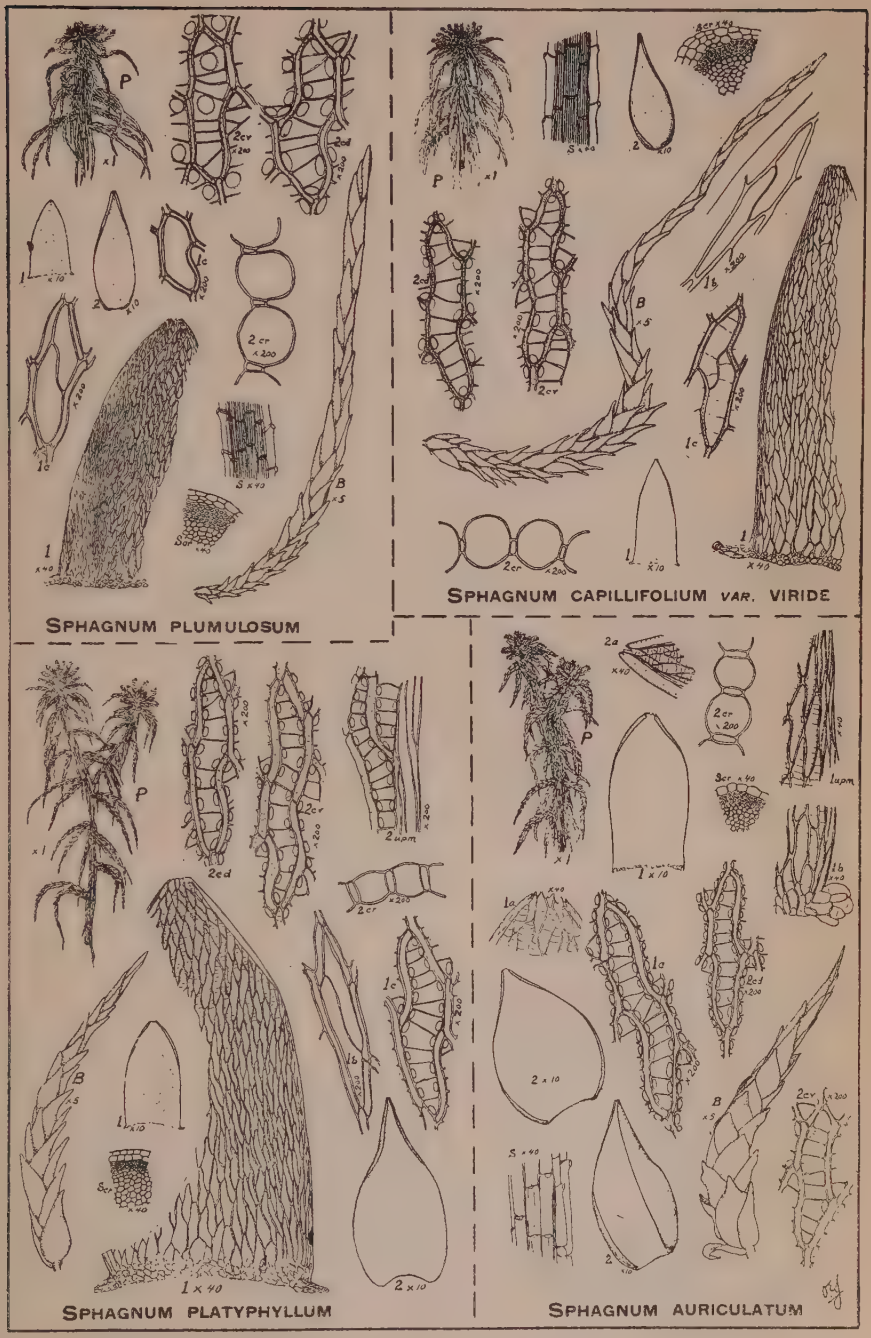

SPHAGNUM PLUMULOSUM
SPHAGNUM CAPILLIFOLIUM VAR. VIRIDE
SPHAGNUM PLATYPHYLLUM
SPHAGNUM AURICULATUM

PLATE V

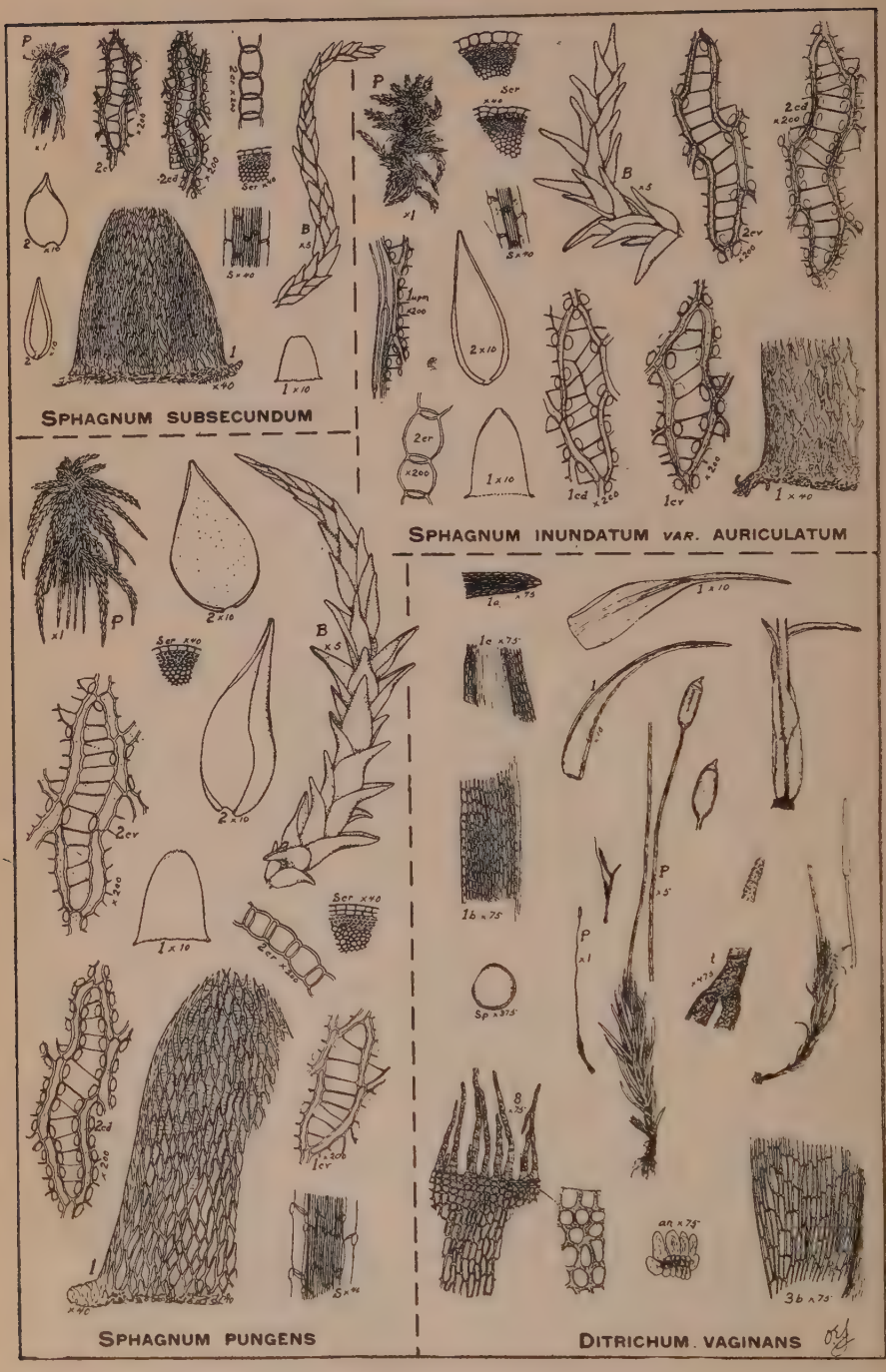

SPHAGNUM SUBSECUNDUM
SPHAGNUM INUNDATUM VAR. AURICULATUM
SPHAGNUM PUNGENS
DITRICHUM VAGINANS

PLATE VI

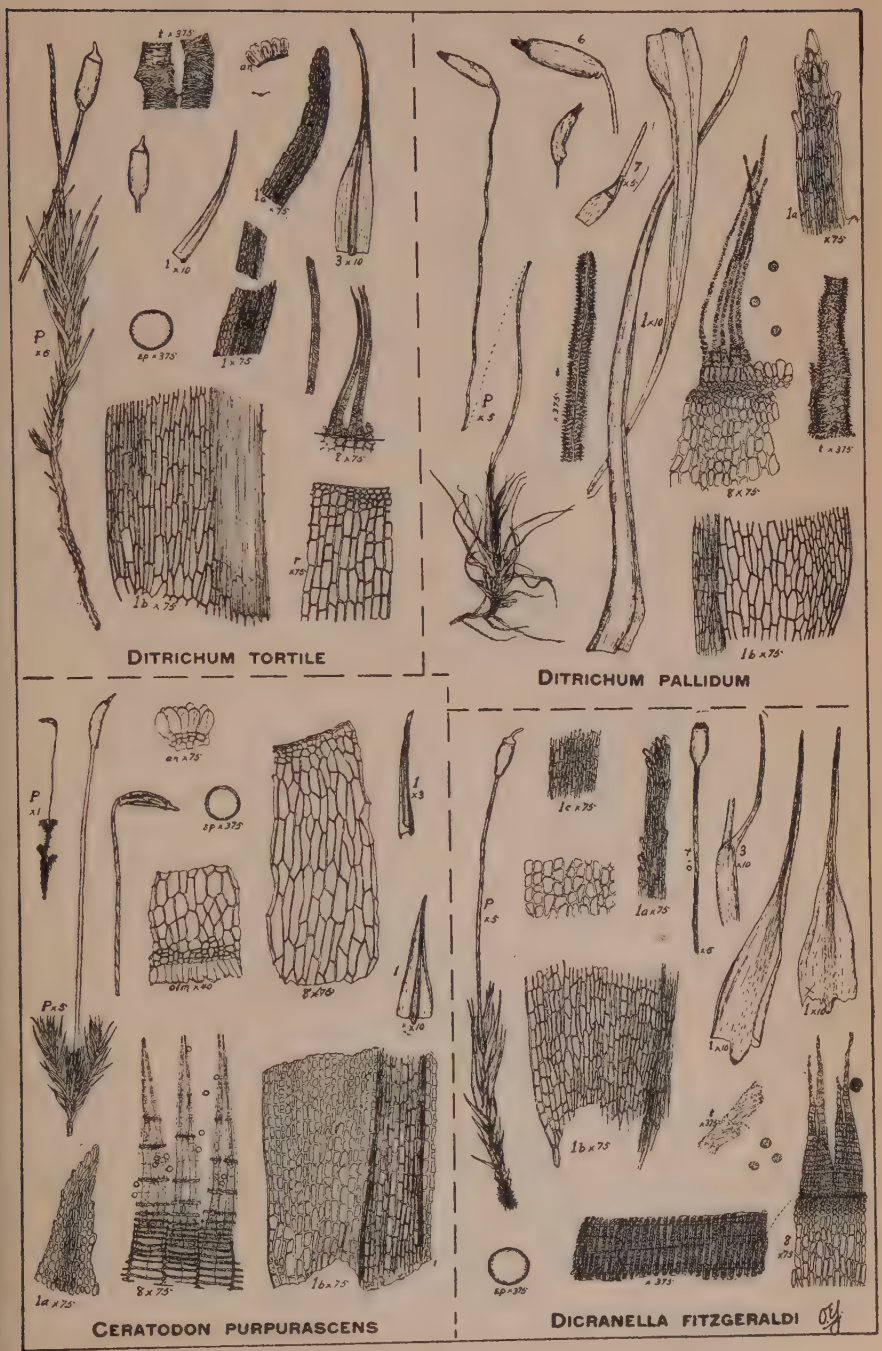

DITRICHUM TORTILE
DITRICHUM PALLIDUM
CERATODON PURPURASCENS
DICRANELLA FITZGERALDI

PLATE VII

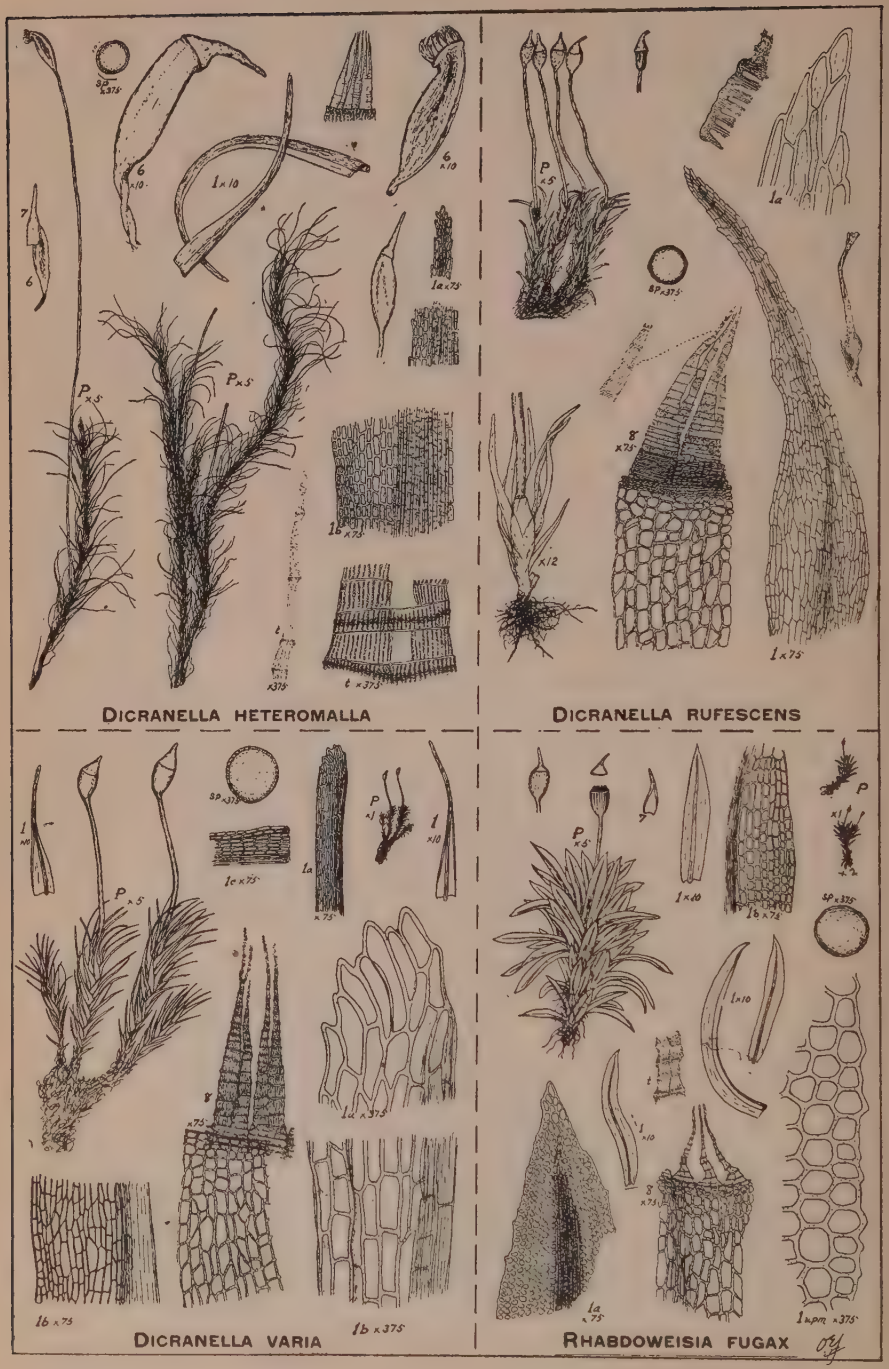

DICRANELLA HETEROMALLA
DICRANELLA RUFESCENS
DICRANELLA VARIA
RHABDOWEISIA FUGAX

PLATE VIII

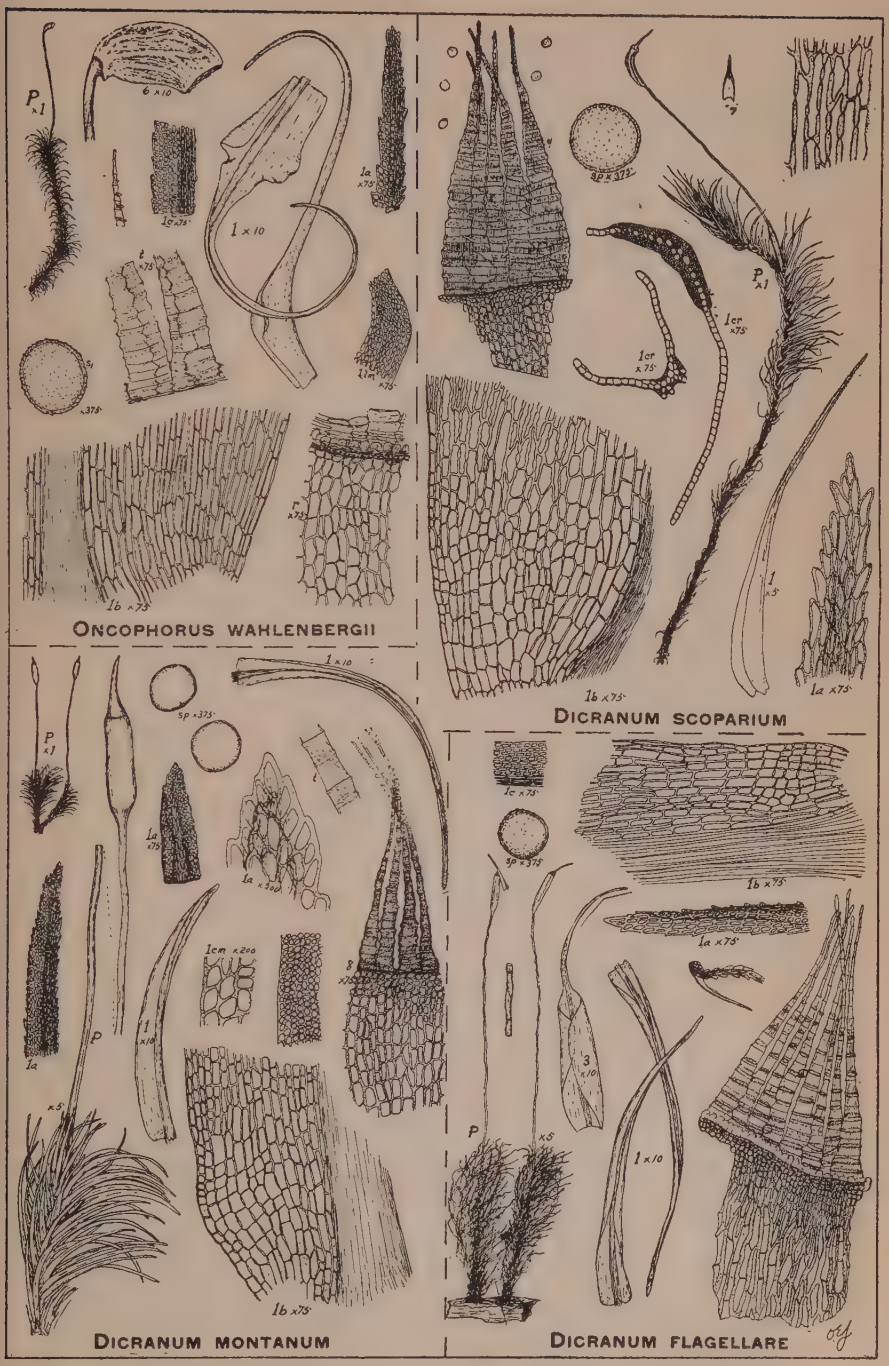

ONCOPHORUS WAHLENBERGII
DICRANUM SCOPARIUM
DICRANUM MONTANUM
DICRANUM FLAGELLARE

PLATE IX

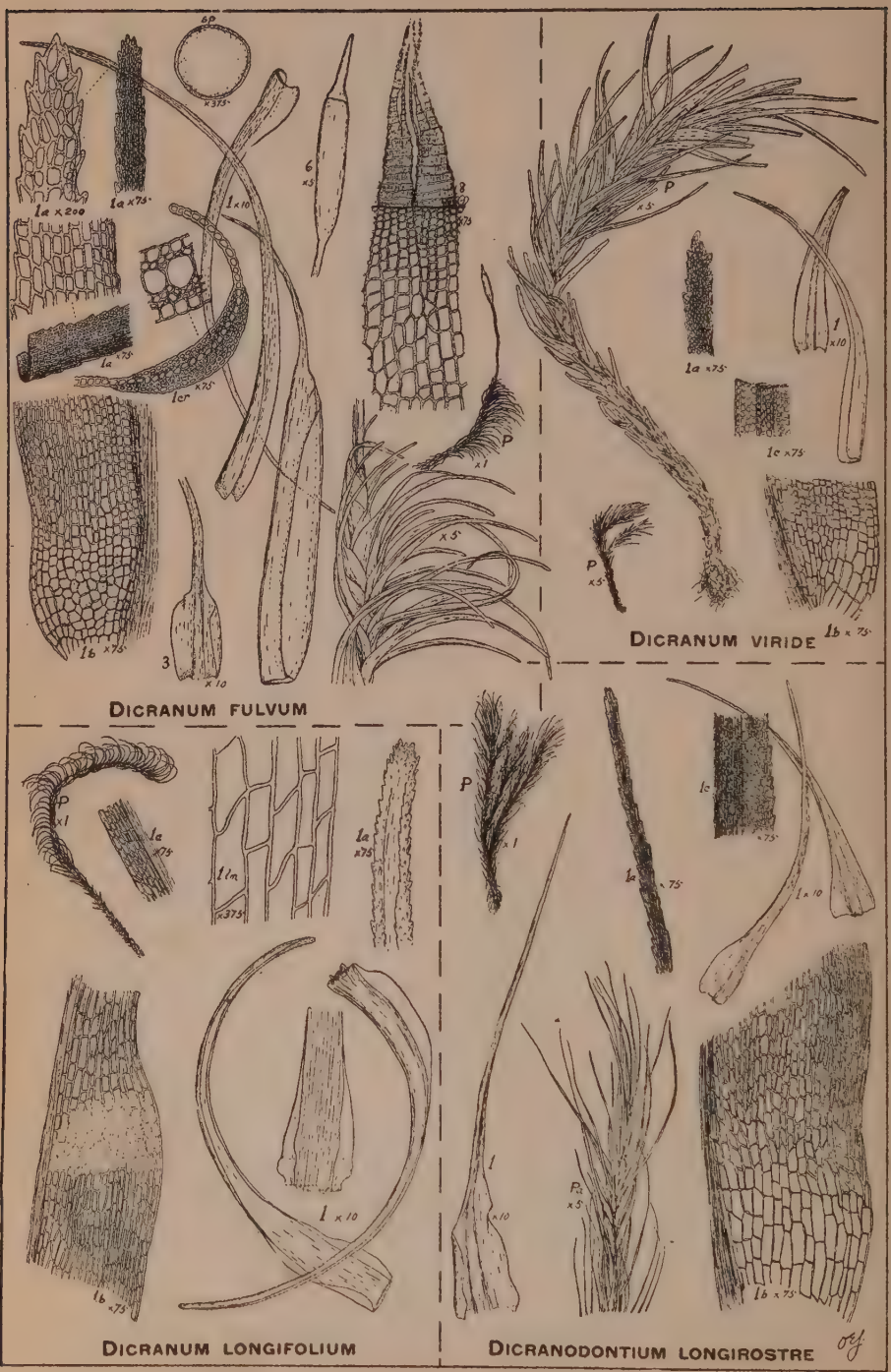

DICRANUM FULVUM
DICRANUM VIRIDE
DICRANUM LONGIFOLIUM
DICRANODONTIUM LONGIROSTRE

PLATE X

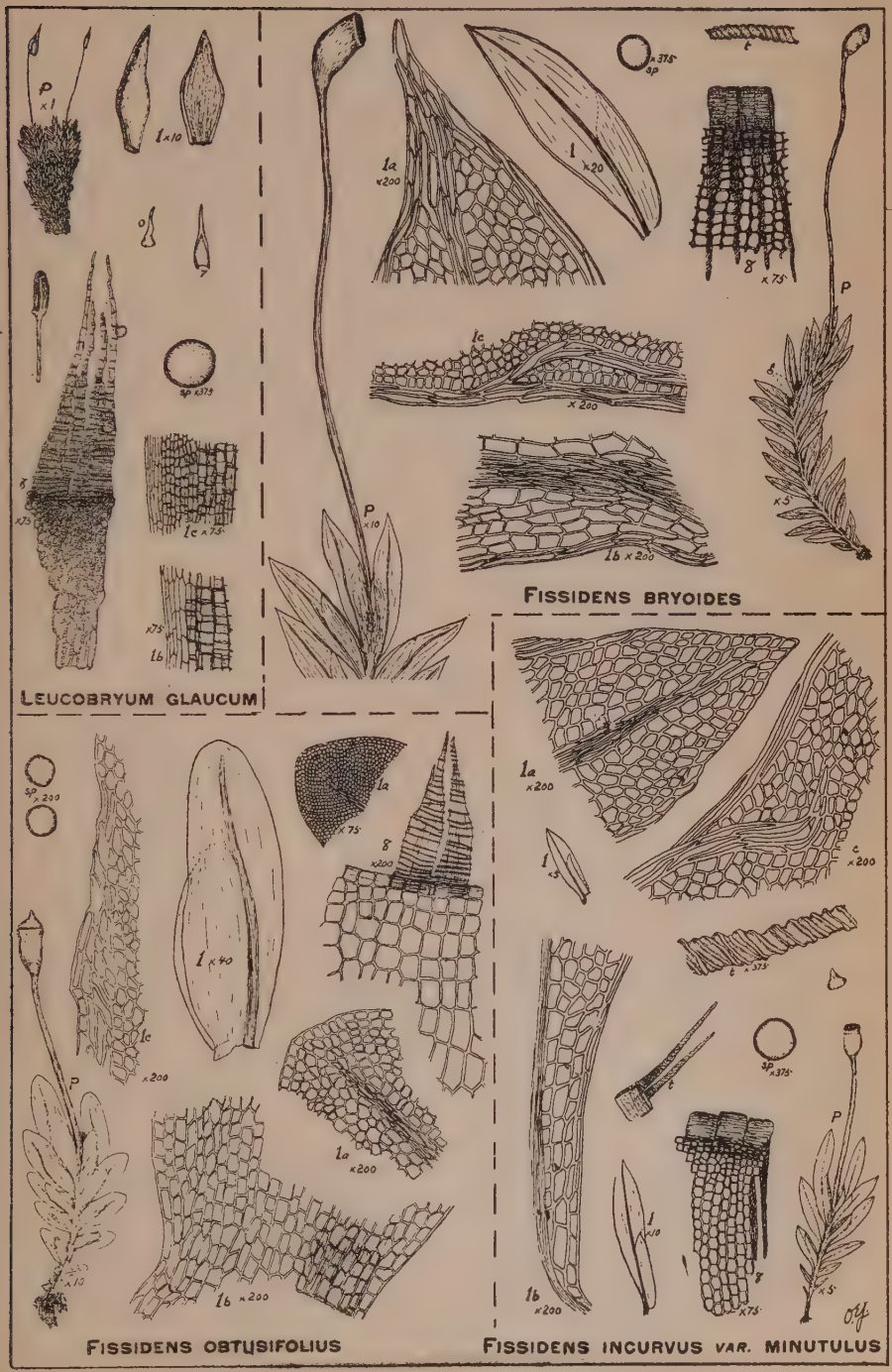

LEUCOBRYUM GLAUCUM
FISSIDENS BRYOIDES
FISSIDENS OBTUSIFOLIUS
FISSIDENS INCURVUS VAR. MINUTULUS

PLATE XI

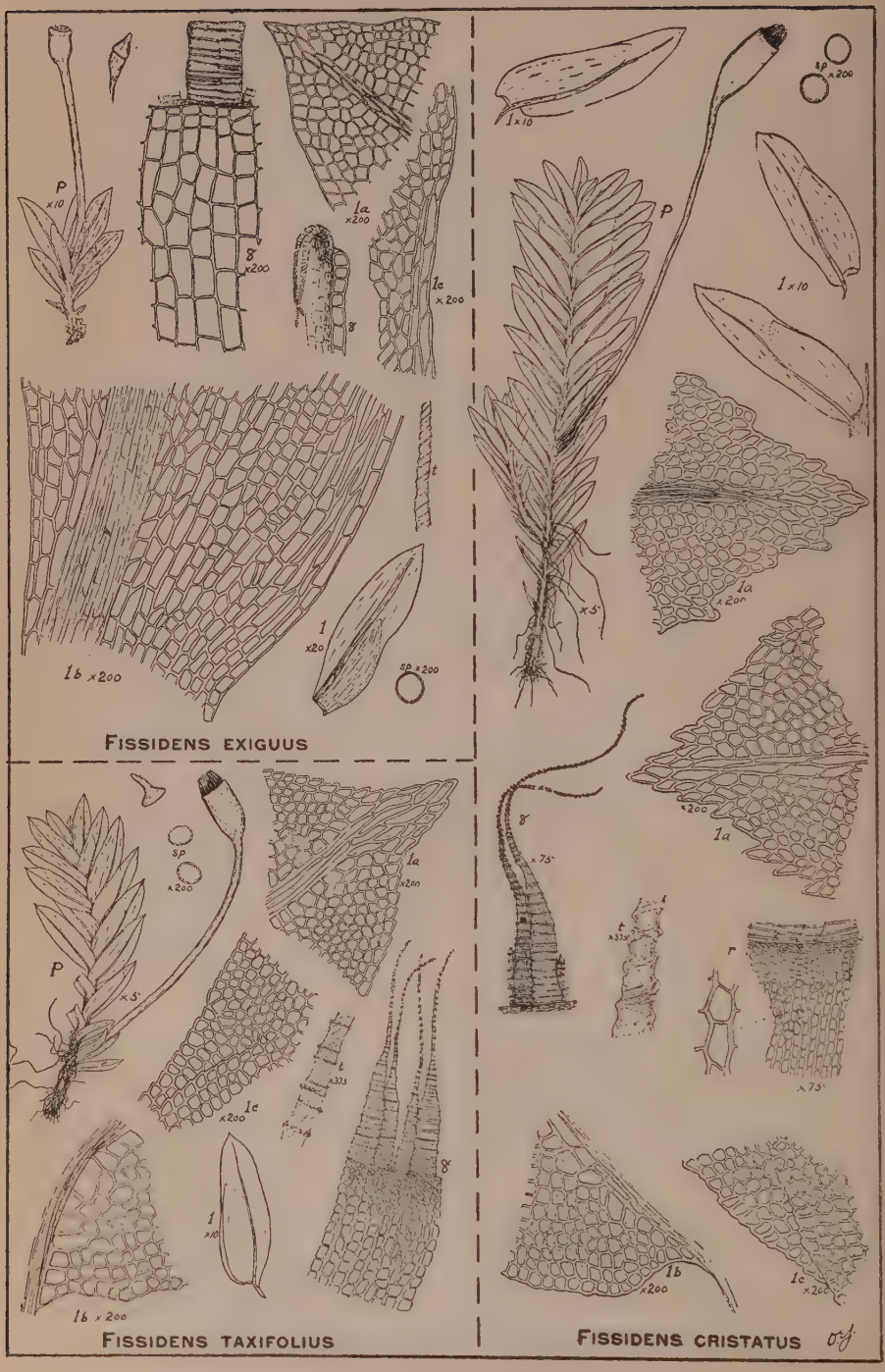

P x10
8 x200
1a x200
1c x200
8
1b x200
t
1 x20
SP x200
FISSIDENS EXIGUUS
1 x10
SP x200
P
x5
1a x200
1 x10
8
x75
1a x200
t x375
r
x75
SP x200
P x5
1a x200
1c x200
t x375
8
1 x10
1b x200
FISSIDENS TAXIFOLIUS
1b x200
1c x200
FISSIDENS CRISTATUS

PLATE XII

FISSIDENS SUBBASILARIS
WEISIA VIRIDULA
HYMENOSTYLIUM CURVIROSTRE
GYMNOSTOMUM CALCAREUM
TRICHOSTOMUM CYLINDRICUM

PLATE XIII

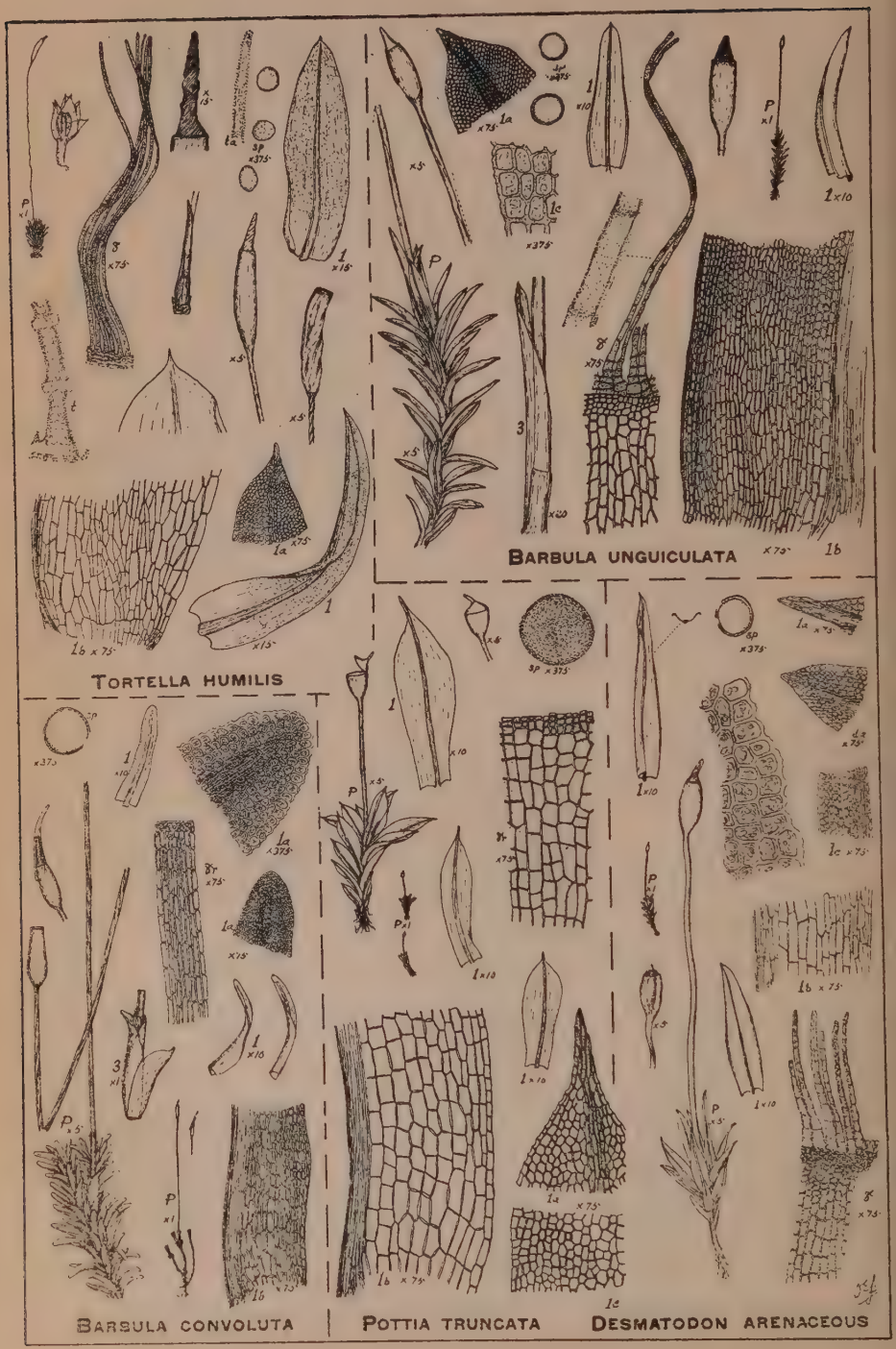

BARBULA UNGUICULATA
TORTELLA HUMILIS
BARBULA CONVOLUTA
POTTIA TRUNCATA
DESMATODON ARENACEOUS

PLATE XIV

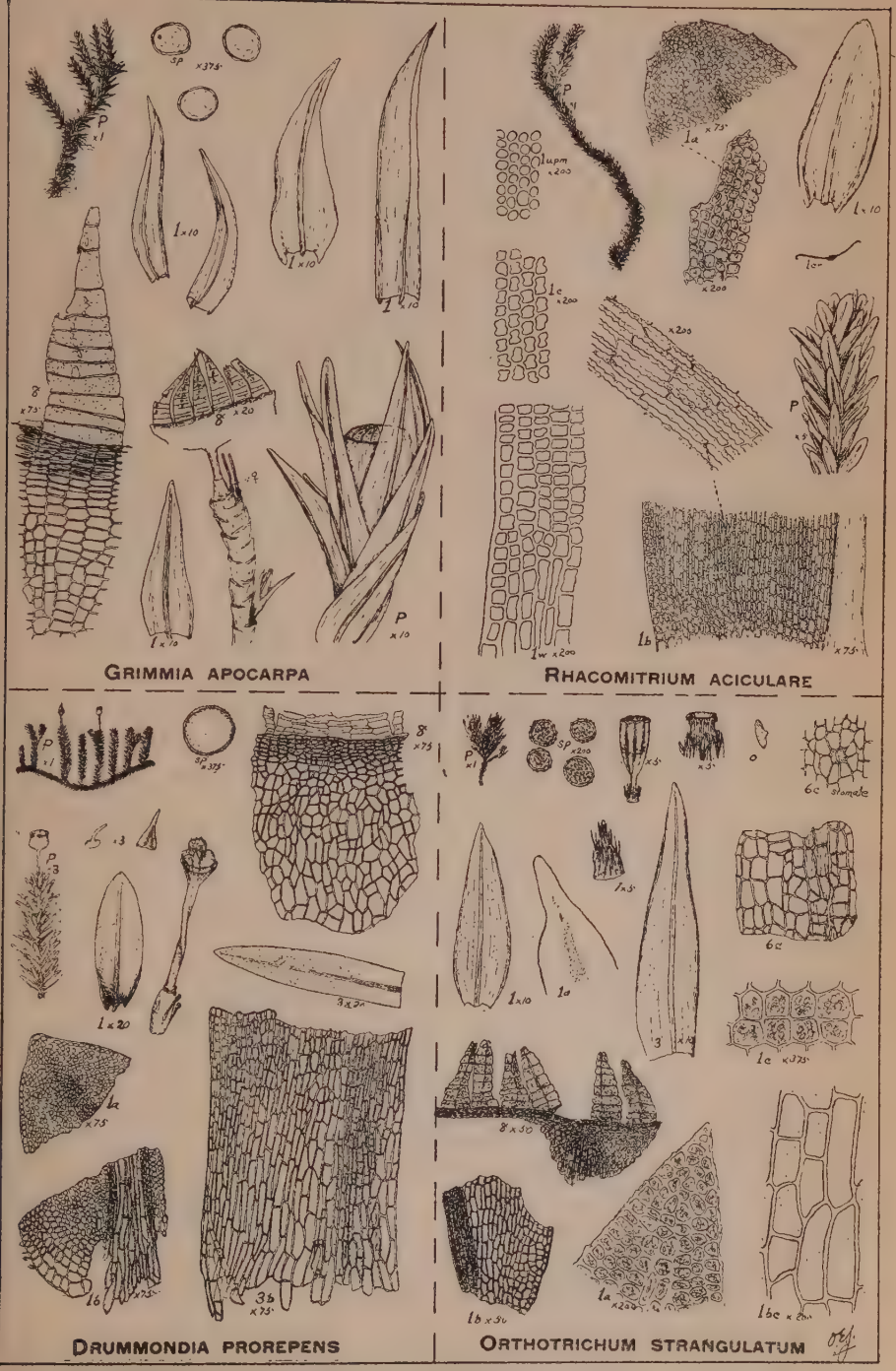

GRIMMIA APOCARPA
RHACOMITRIUM ACICULARE
DRUMMONDIA PROREPENS
ORTHOTRICHUM STRANGULATUM

PLATE XV

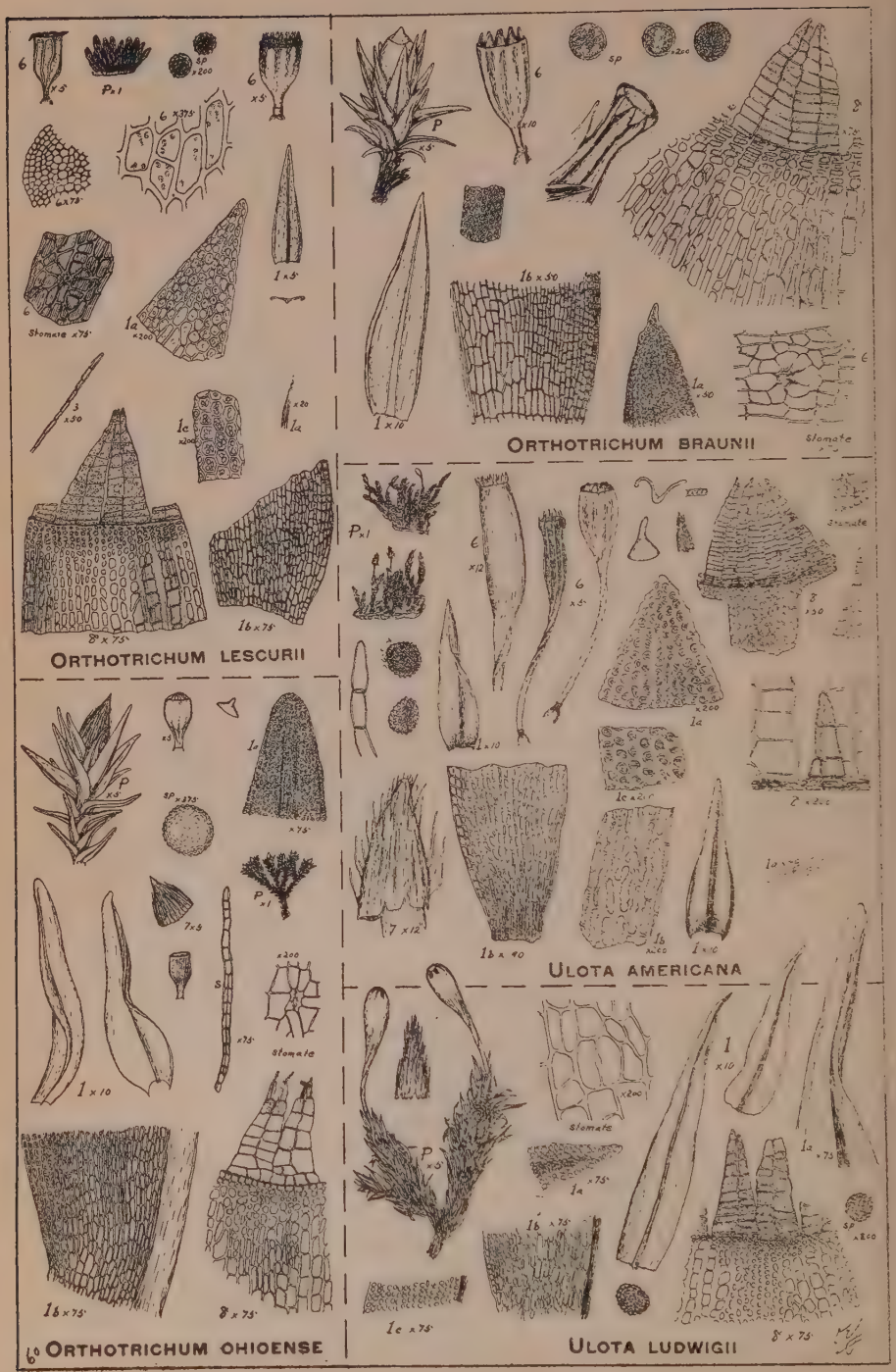
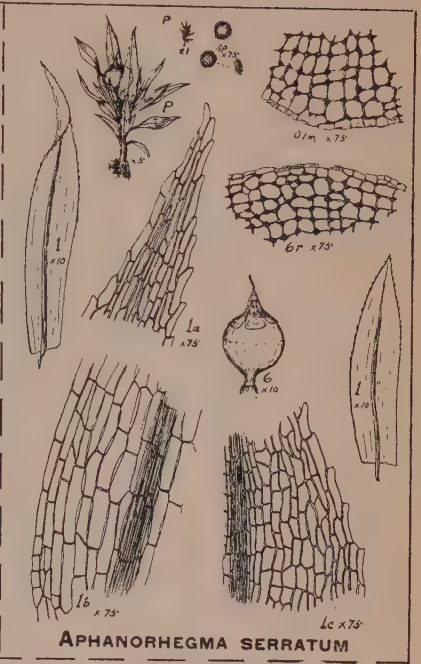
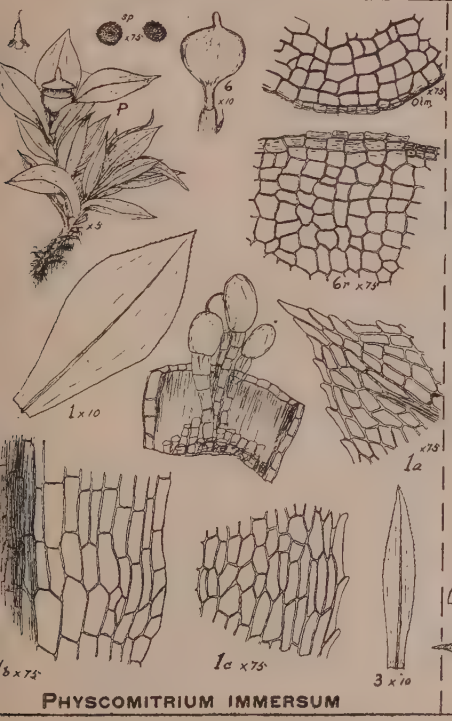

ORTHOTRICHUM BRAUNII
ORTHOTRICHUM LESCURII
ULOTA AMERICANA
ORTHOTRICHUM OHIOENSE
ULOTA LUDWIGII

PLATE XVI

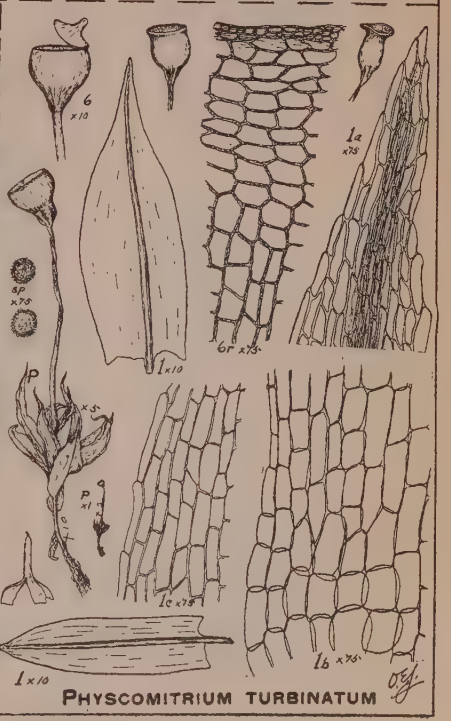
ULOTA CRISPA



APHANORHEGMA SERRATUM



PHYSCOMITRIUM IMMERSUM



PHYSCOMITRIUM TURBINATUM

PLATE XVII

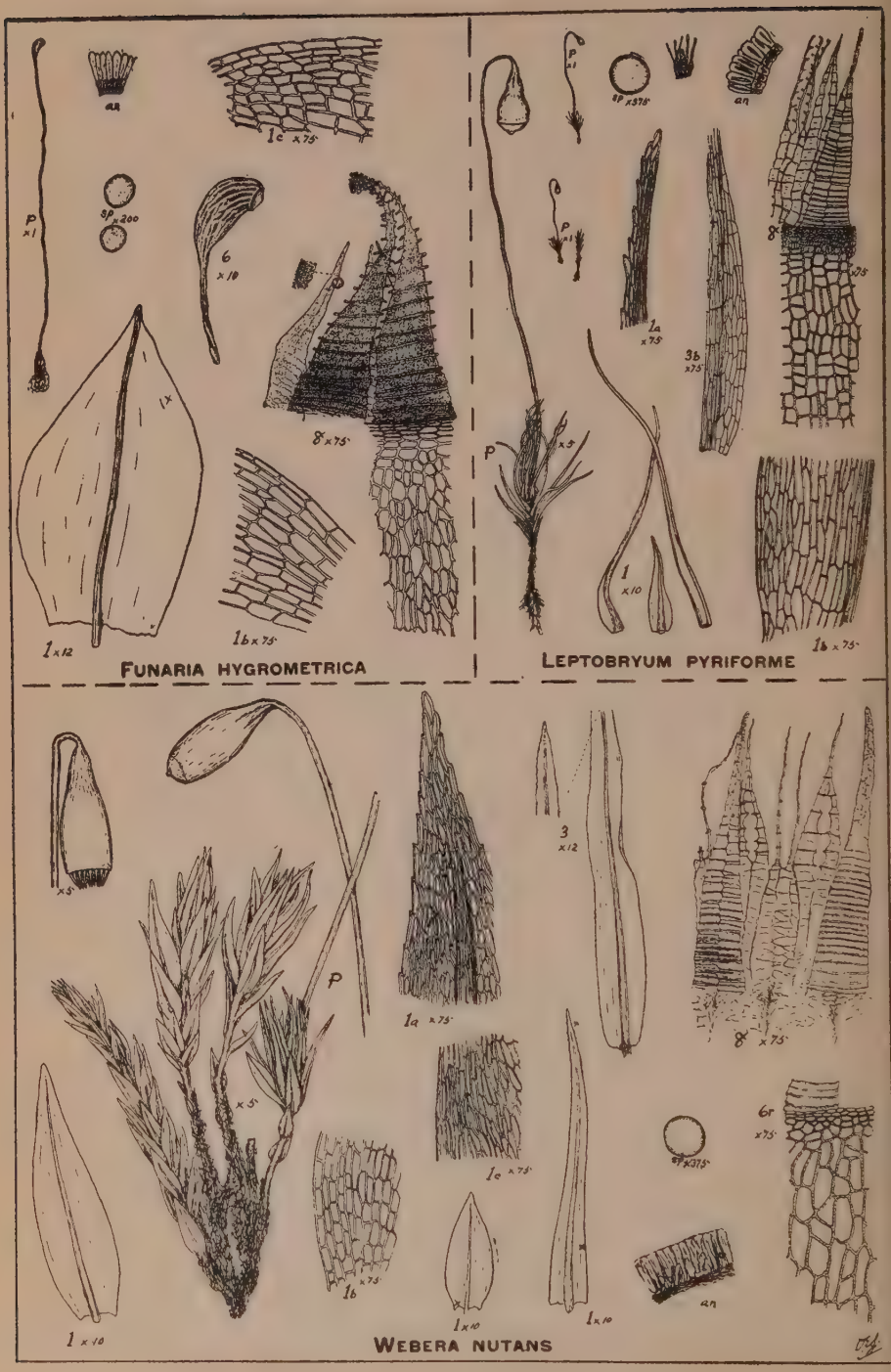

FUNARIA HYGROMETRICA
LEPTOBRYUM PYRIFORME
WEBERA NUTANS

PLATE XVIII

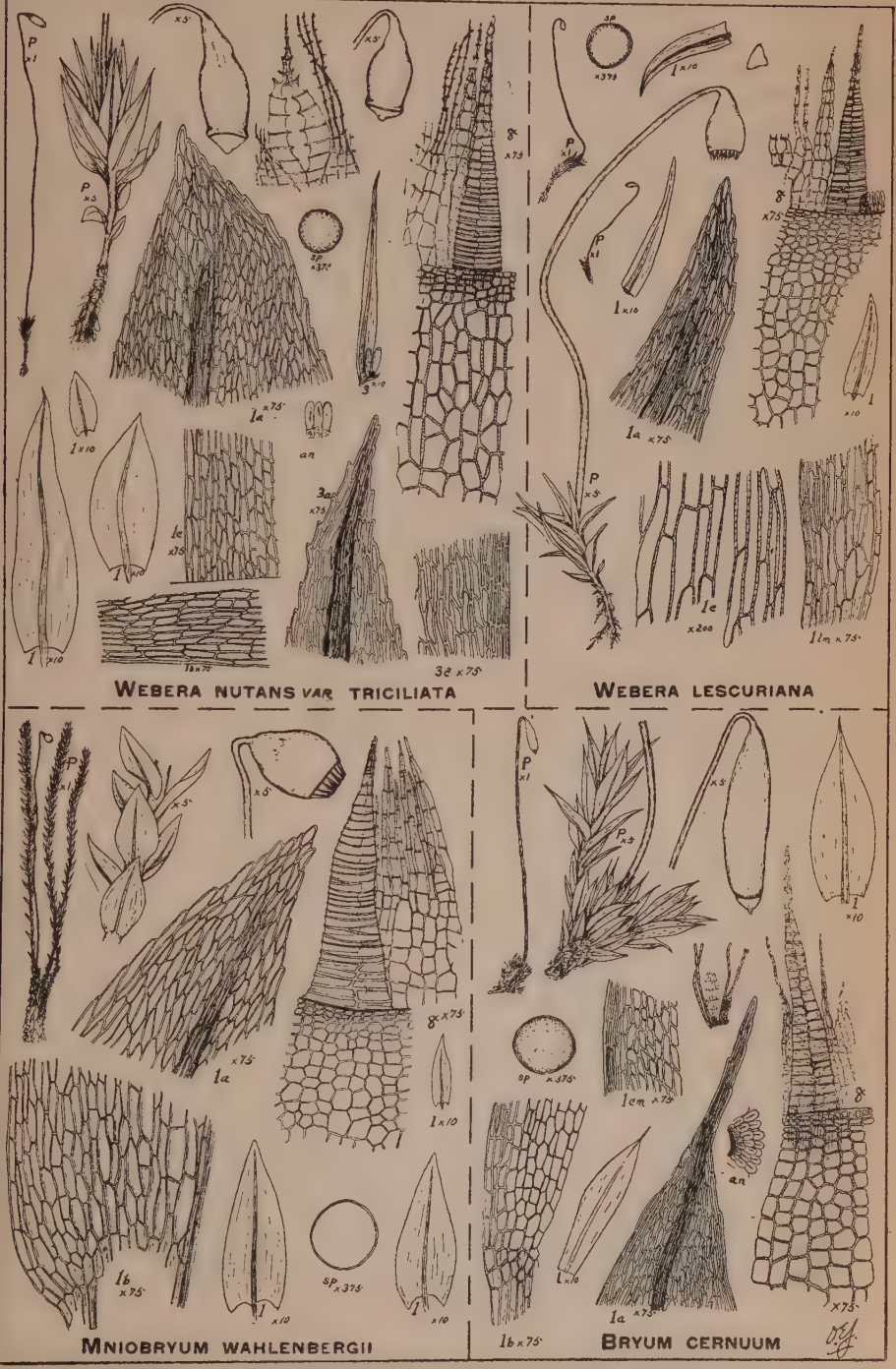

WEBERA NUTANS VAR TRICILIATA
WEBERA LESCURIANA
MNIOBRYUM WAHLENBERGII
BRYUM CERNUUM

PLATE XIX

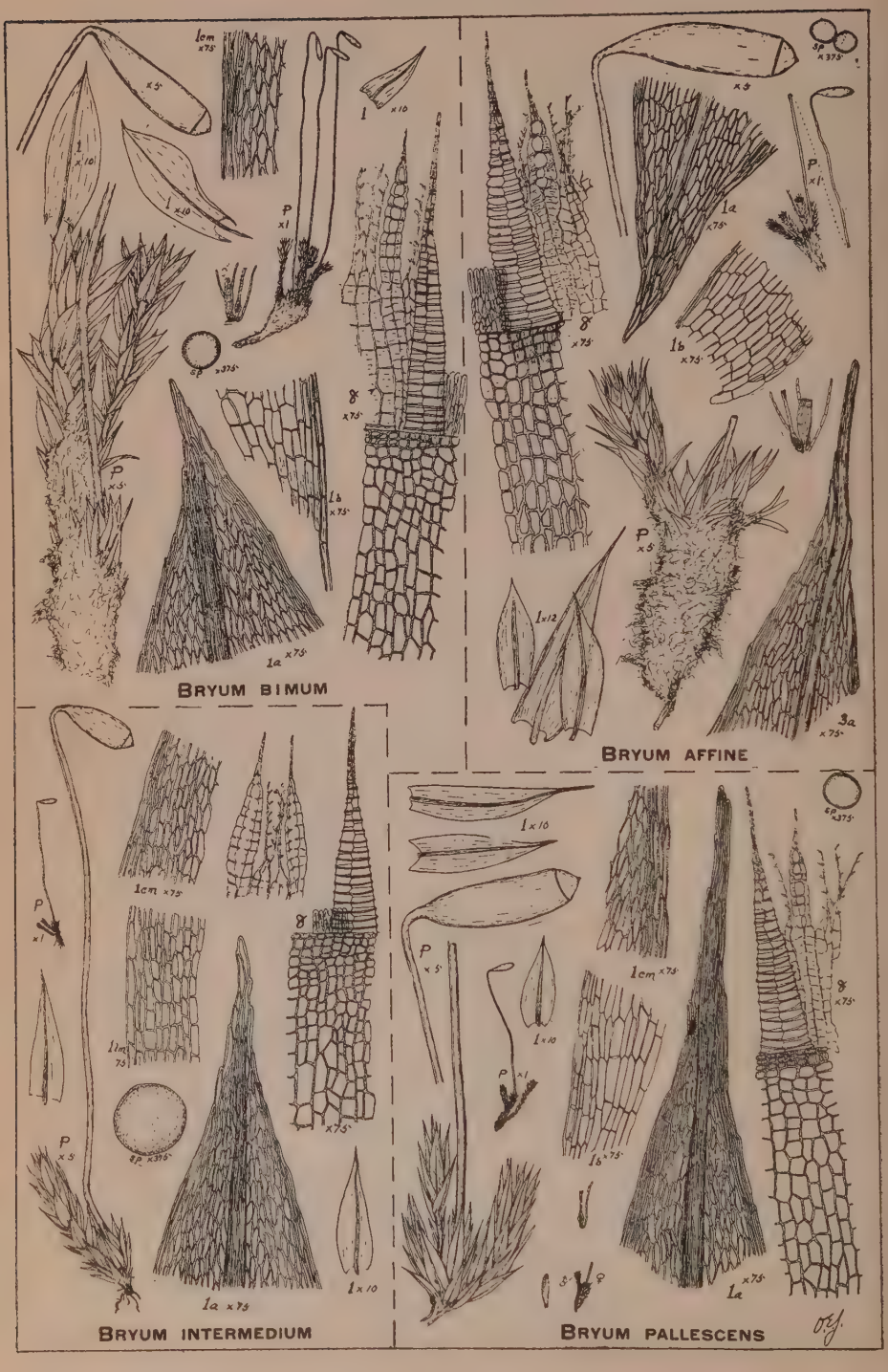

BRYUM BIMUM
BRYUM AFFINE
BRYUM INTERMEDIUM
BRYUM PALLESCENS

PLATE XX

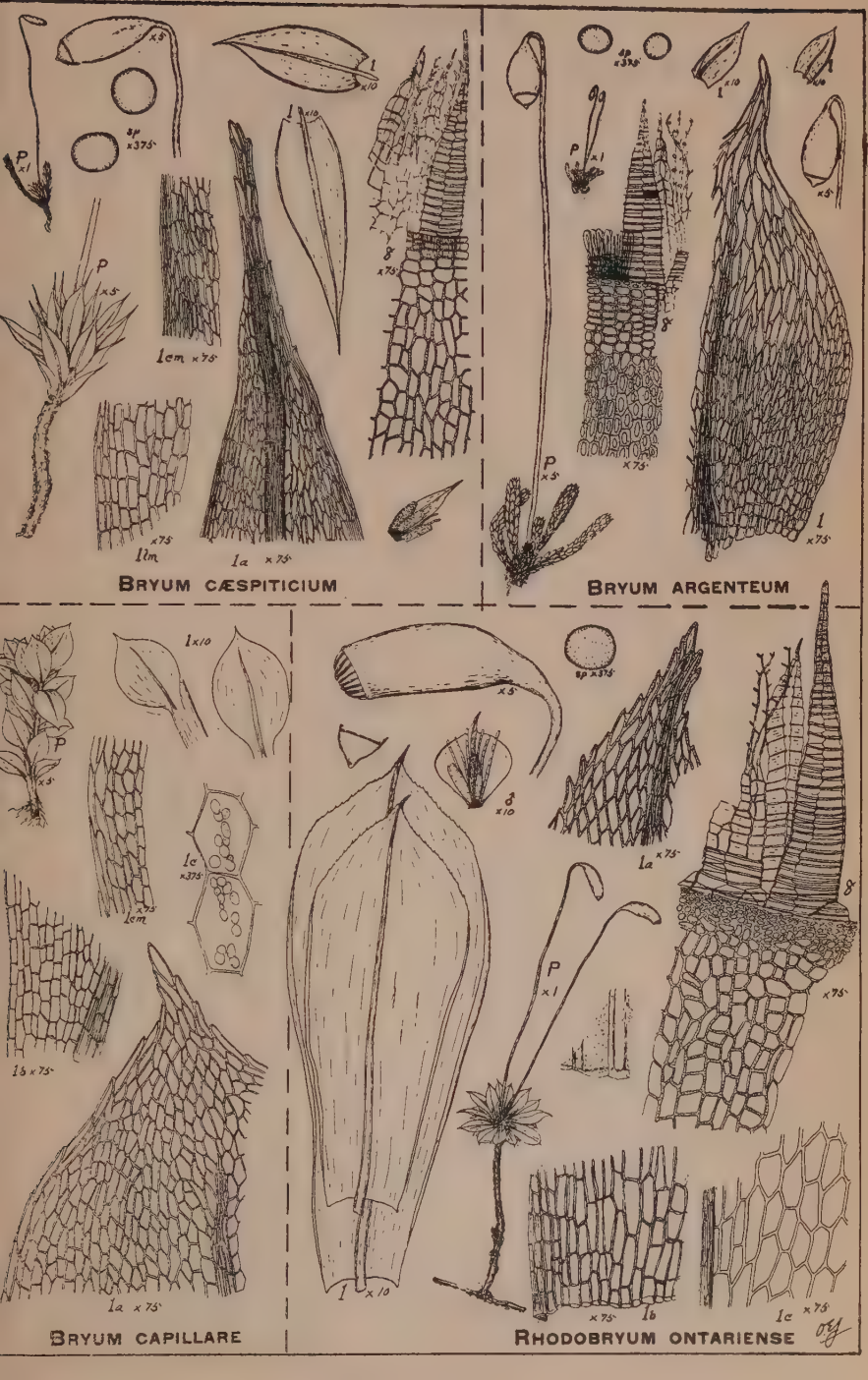

BRYUM CÆSPITICIUM
BRYUM ARGENTEUM
BRYUM CAPILLARE
RHODOBRYUM ONTARIENSE

PLATE XXI

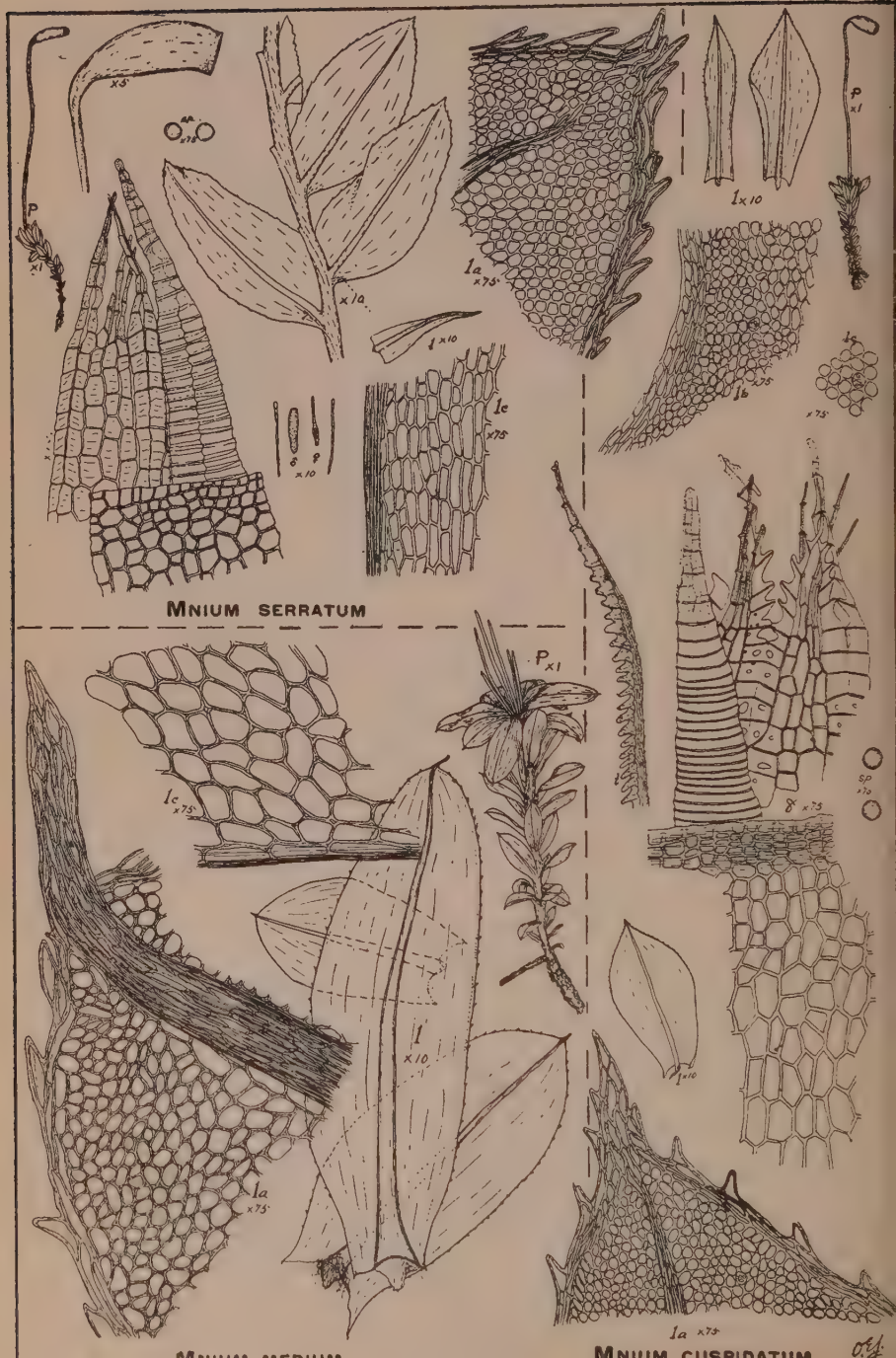


PLATE XXII

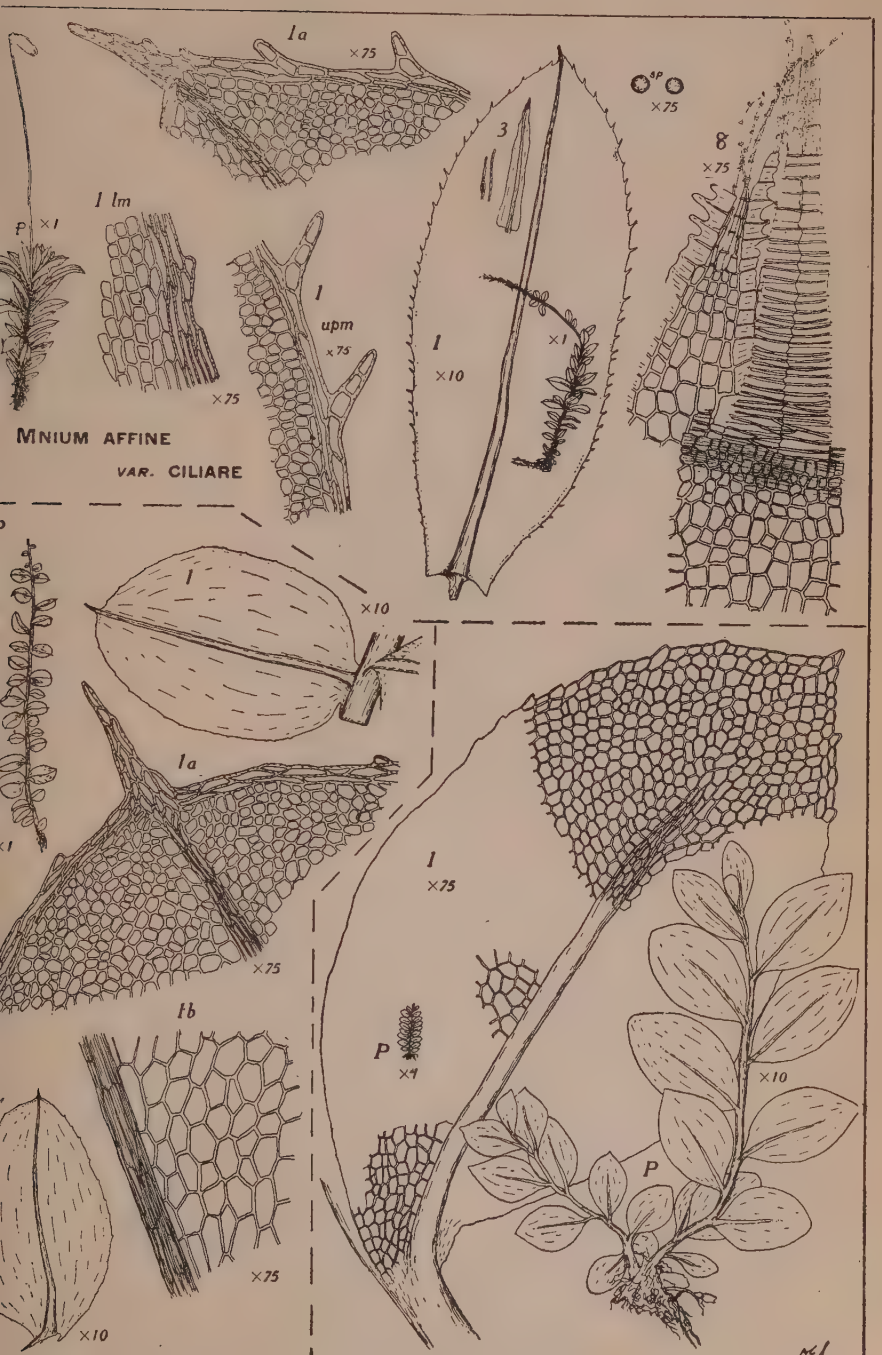

1a
×75
1 lm
P ×1
×75
1
upm
×75
MNIUM AFFINE
VAR. CILIARE
3
SP
×75
1
×10
×1
8
×75
1
×10
1a
×75
1b
×75
×10
1
×75
P
×1
P
×10

PLATE XXIII

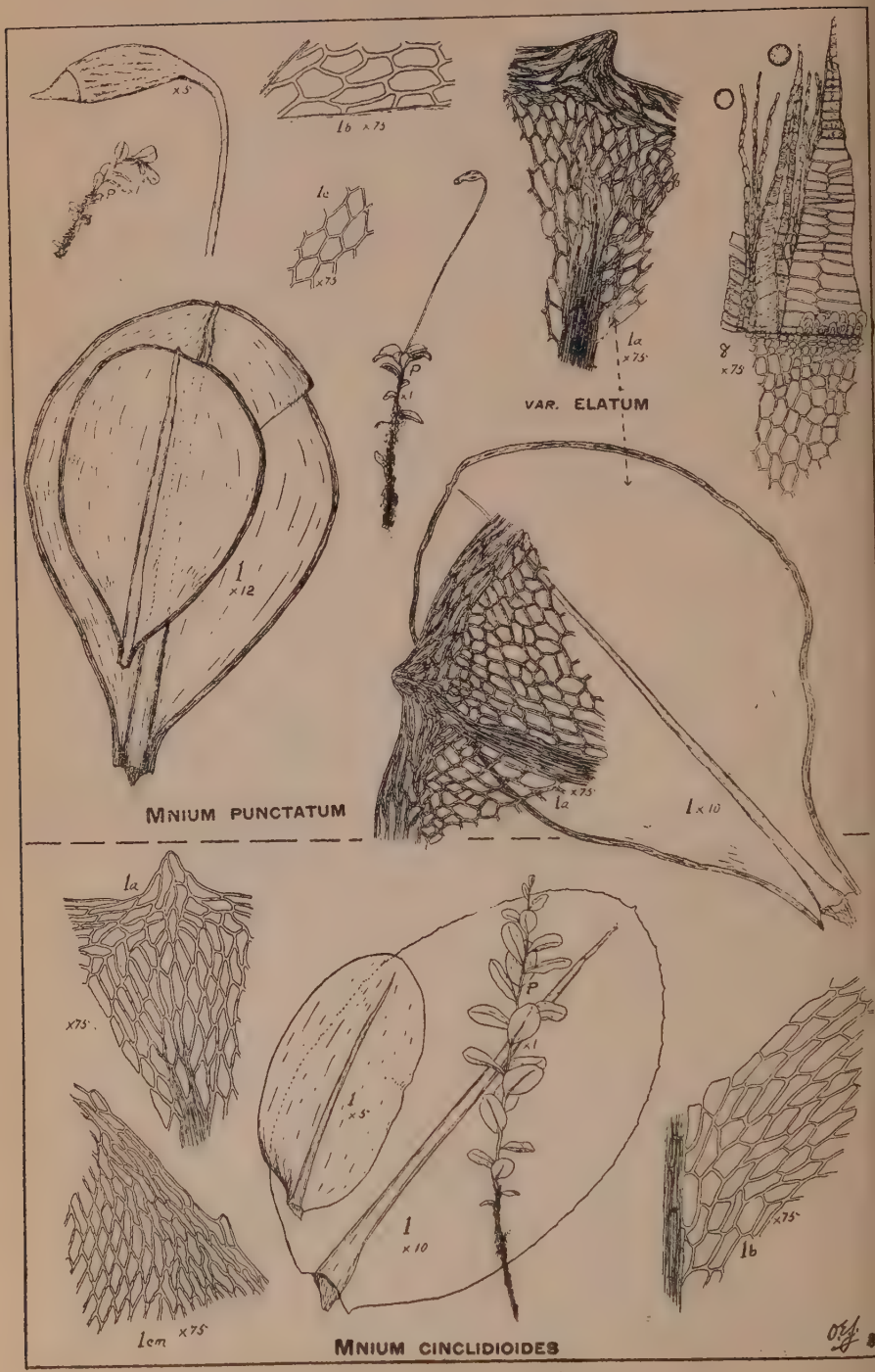

x3
1b x75
P x1
1c x75
1a x75
VAR. ELATUM
8 x75
P x1
1 x12
MNIUM PUNCTATUM
1a x75
1 x10
1a x75
1 x5
P x1
1 x10
1b x75
1cm x75
MNIUM CINCLIDIOIDES

PLATE XXIV

AULACOMNIUM HETEROSTICHUM
AULACOMNIUM PALUSTRE
BARTRAMIA POMIFORMIS
PHILONOTIS MUHLENBERGII

PLATE XXV

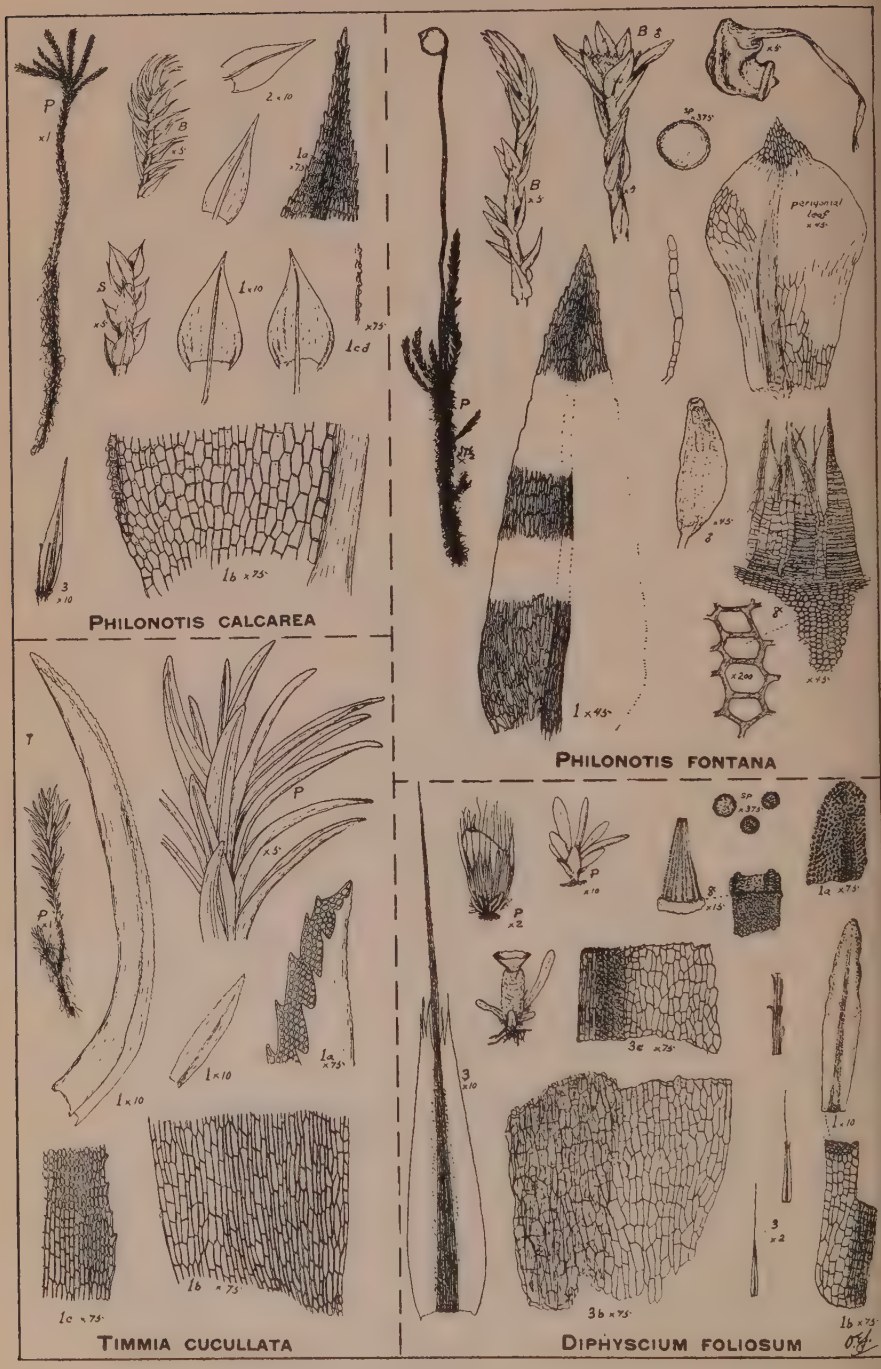

PHILONOTIS CALCAREA
PHILONOTIS FONTANA
TIMMIA CUCULLATA
DIPHYSCIUM FOLIOSUM

PLATE XXVI

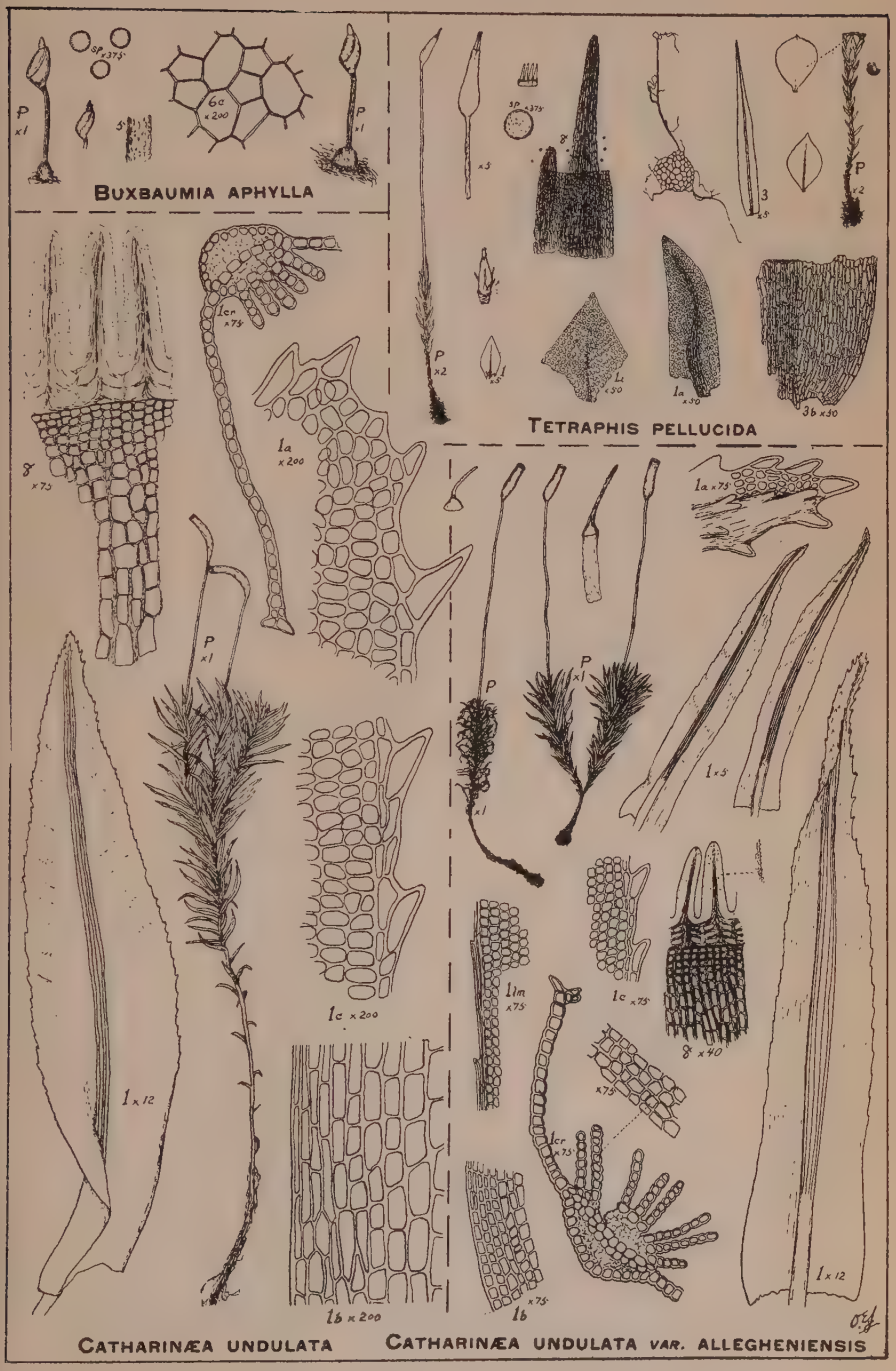

BUXBAUMIA APHYLLA
TETRAPHIS PELLUCIDA
CATHARINÆA UNDULATA
CATHARINÆA UNDULATA VAR. ALLEGHENIENSIS

PLATE XXVII

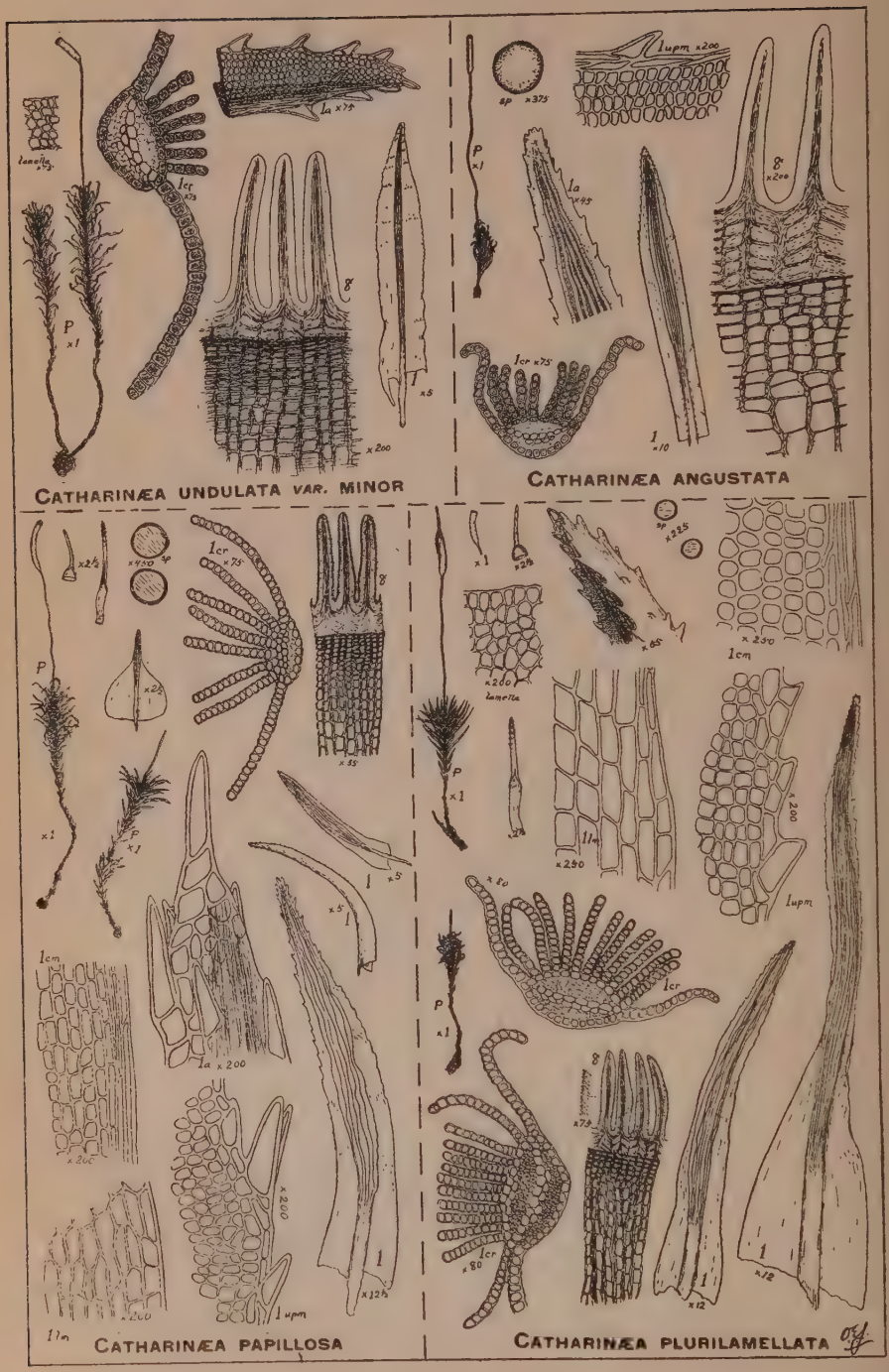

CATHARINÆA UNDULATA VAR. MINOR
CATHARINÆA ANGUSTATA
CATHARINÆA PAPILLOSA
CATHARINÆA PLURILAMELLATA

PLATE XXVIII

PLATE XXIX

POLYTRICHUM COMMUNE
POLYTRICHUM JUNIPERINUM
POLYTRICHUM ALPESTRE

PLATE XXX

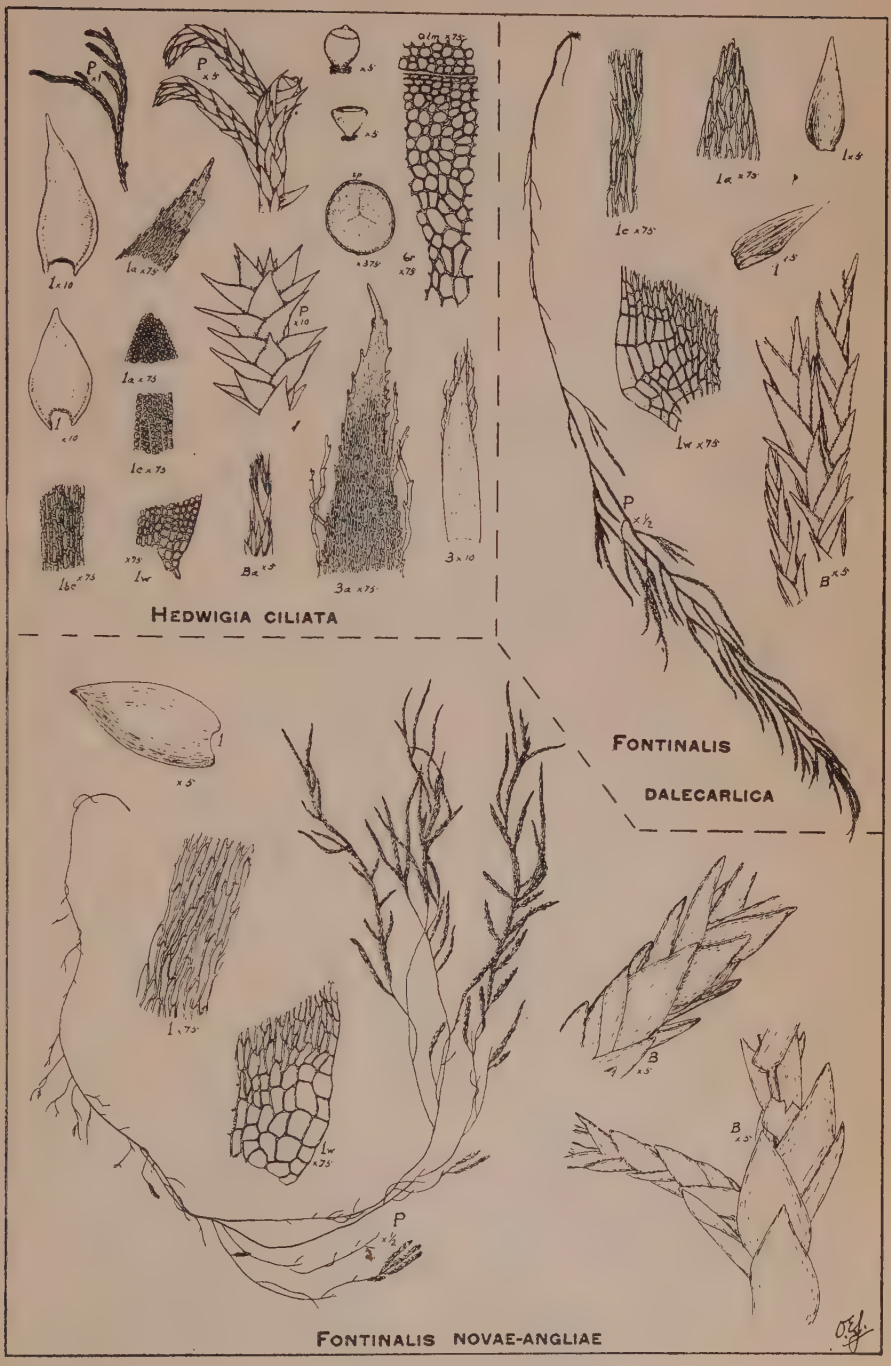

HEDWIGIA CILIATA
FONTINALIS DALECARLICA
FONTINALIS NOVAE-ANGLIAE

PLATE XXXI

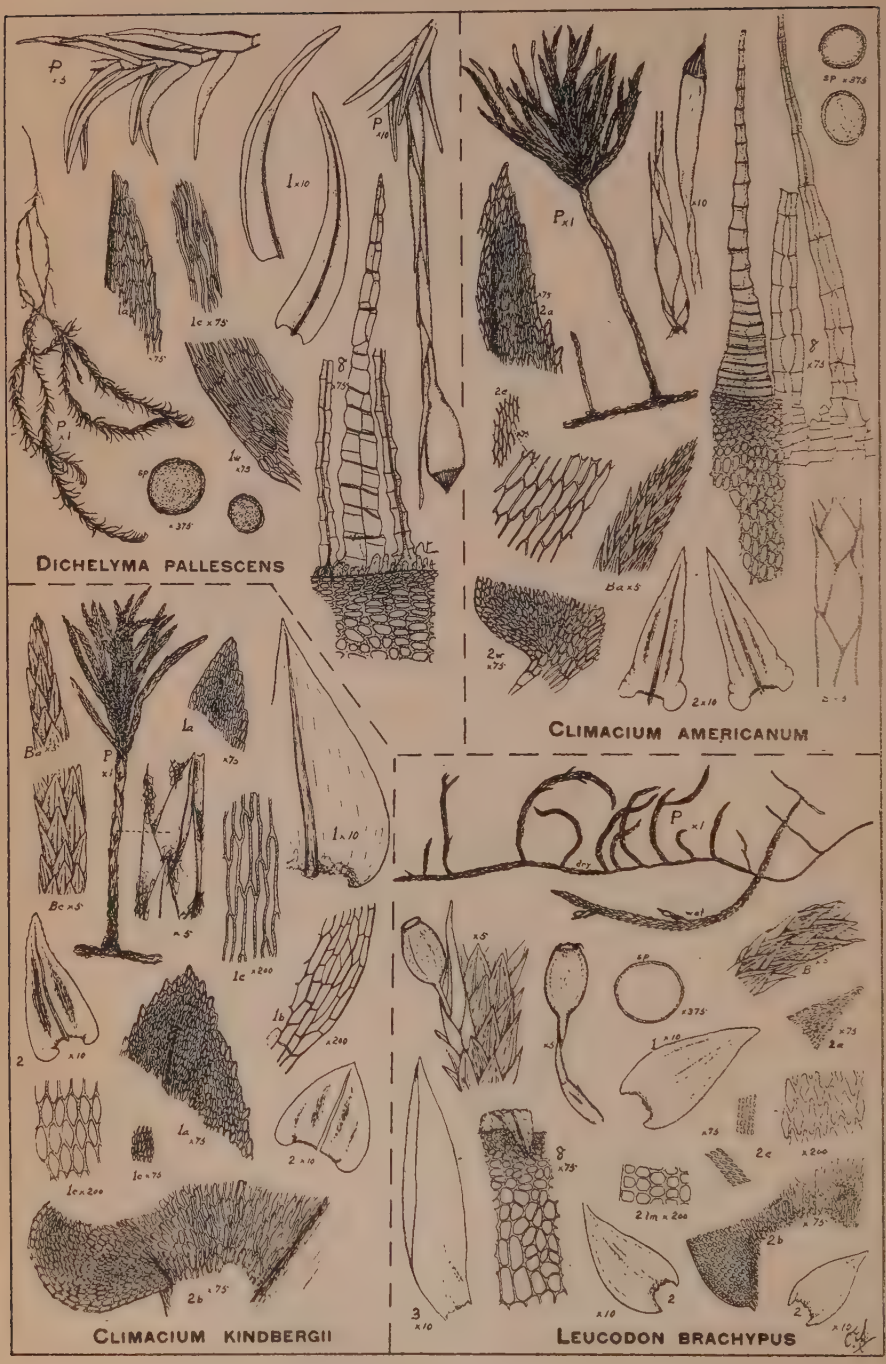

DICHELYMA PALLESCENS
CLIMACIUM AMERICANUM
CLIMACIUM KINDBERGII
LEUCODON BRACHYPUS

PLATE XXXII

LEUCODON JULACEUS
FORRSTROEMIA TRICHOMITRIA
SCHWETSCHKEOPSIS DENTICULATA
THAMNIUM ALLEGHENIENSE
ENTODON CLADORRHIZANS

PLATE XXXIII

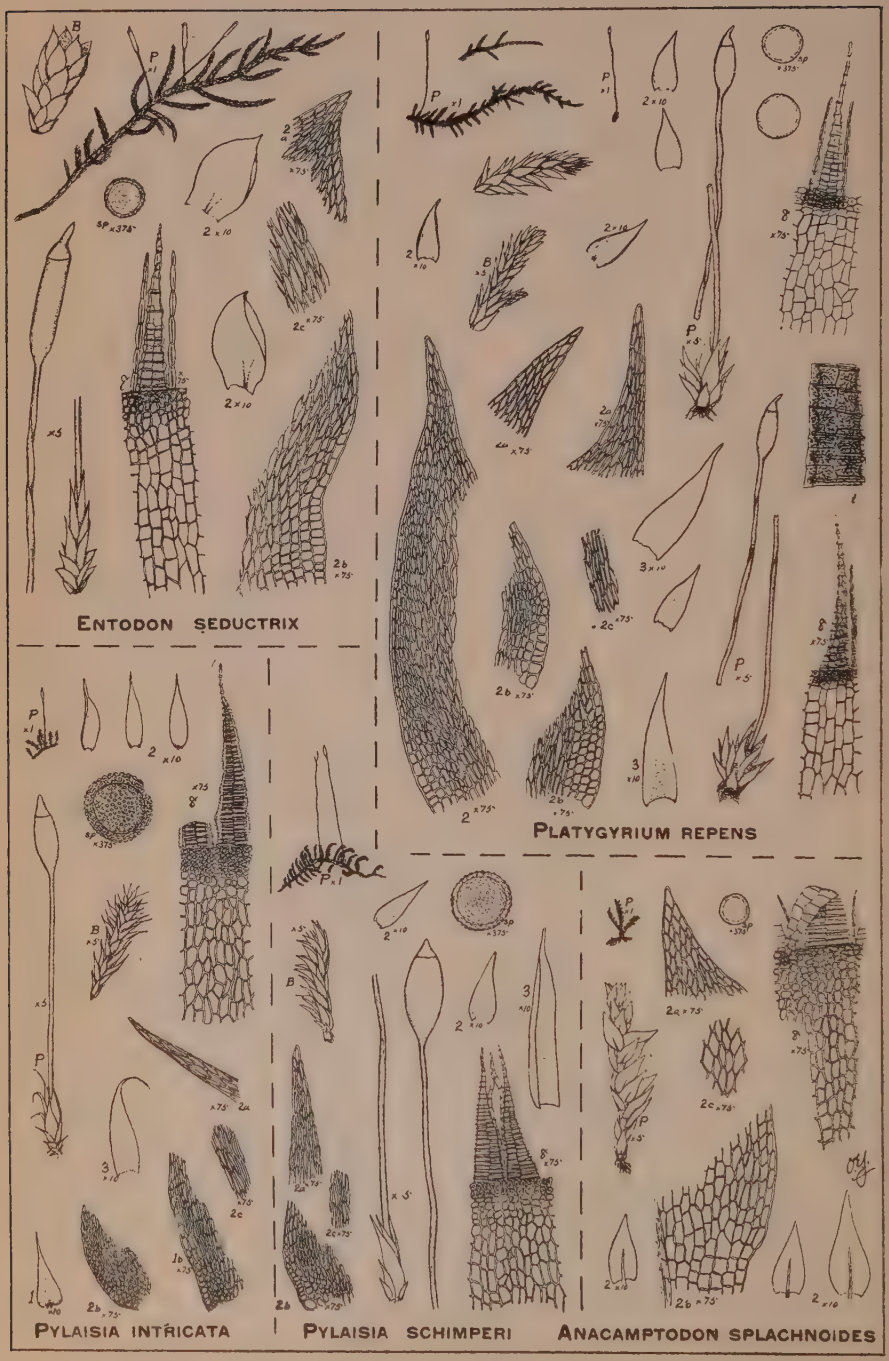


PLATE XXXIV

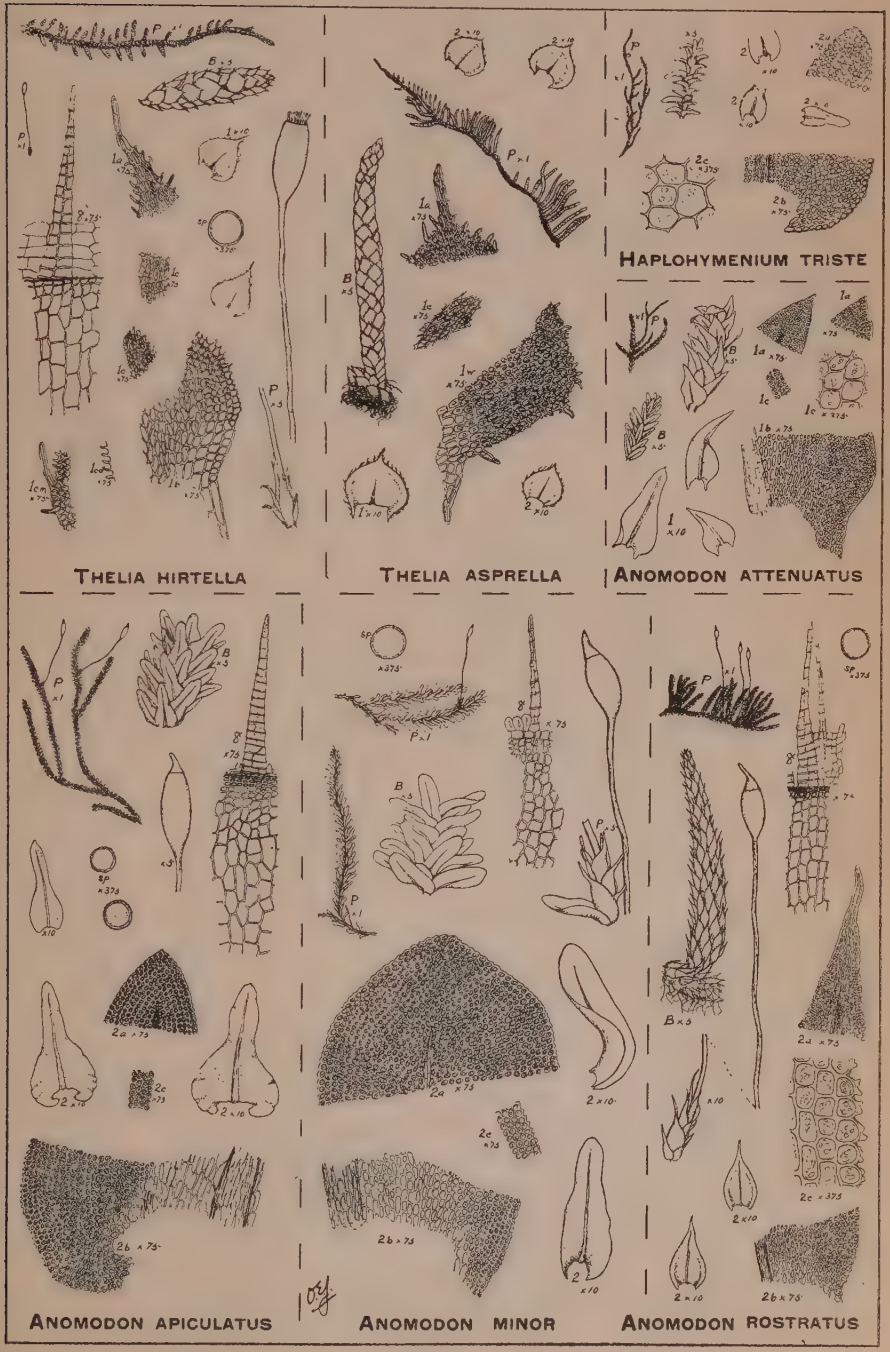

THELIA HIRTELLA
THELIA ASPRELLA
HAPLOHYMENIUM TRISTE
ANOMODON ATTENUATUS
ANOMODON APICULATUS
ANOMODON MINOR
ANOMODON ROSTRATUS

PLATE XXXV

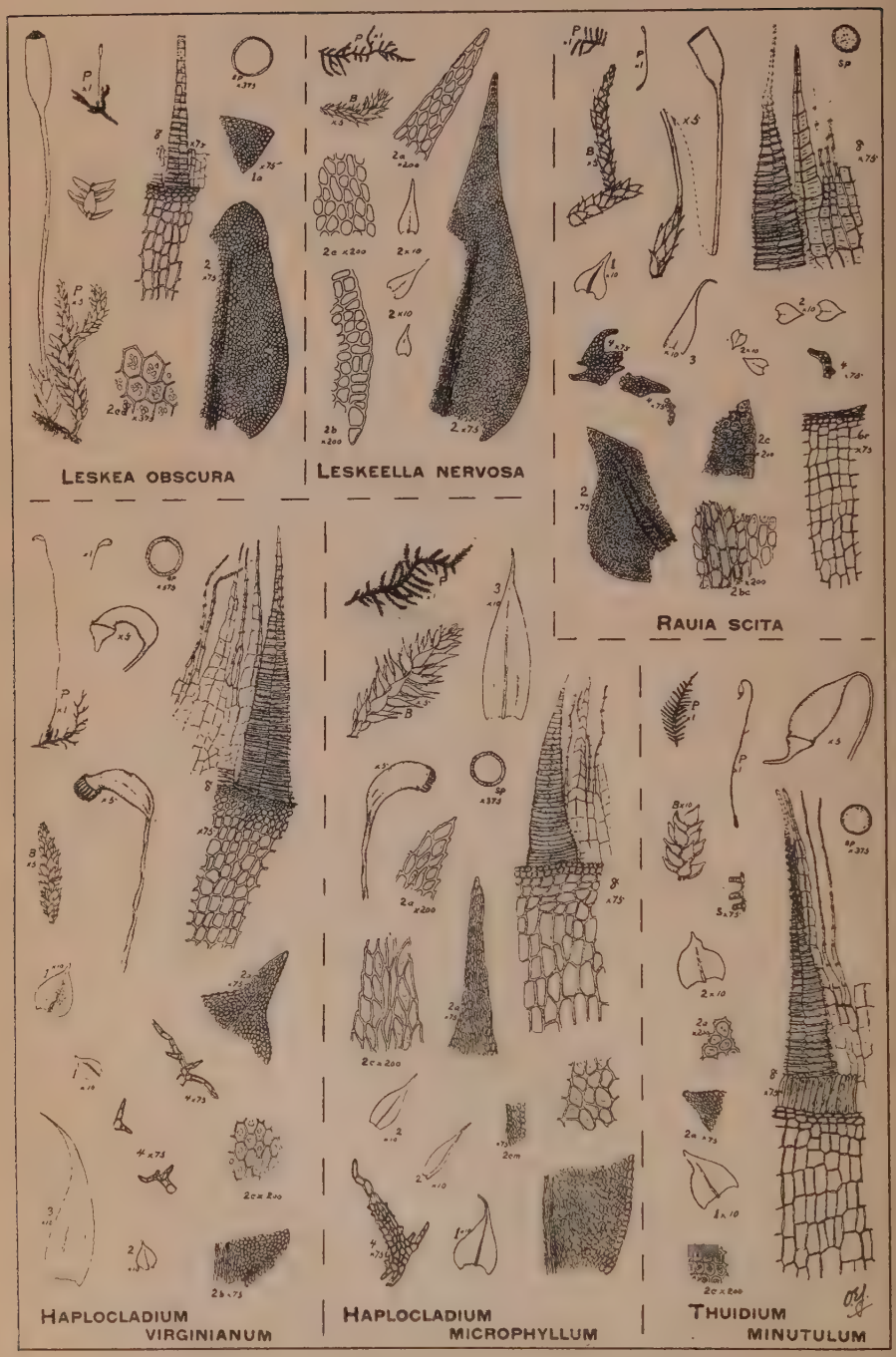

LESKEA OBSCURA
LESKEELLA NERVOSA
RAUIA SCITA
HAPLOCLADIUM VIRGINIANUM
HAPLOCLADIUM MICROPHYLLUM
THUIDIUM MINUTULUM

PLATE XXXVI

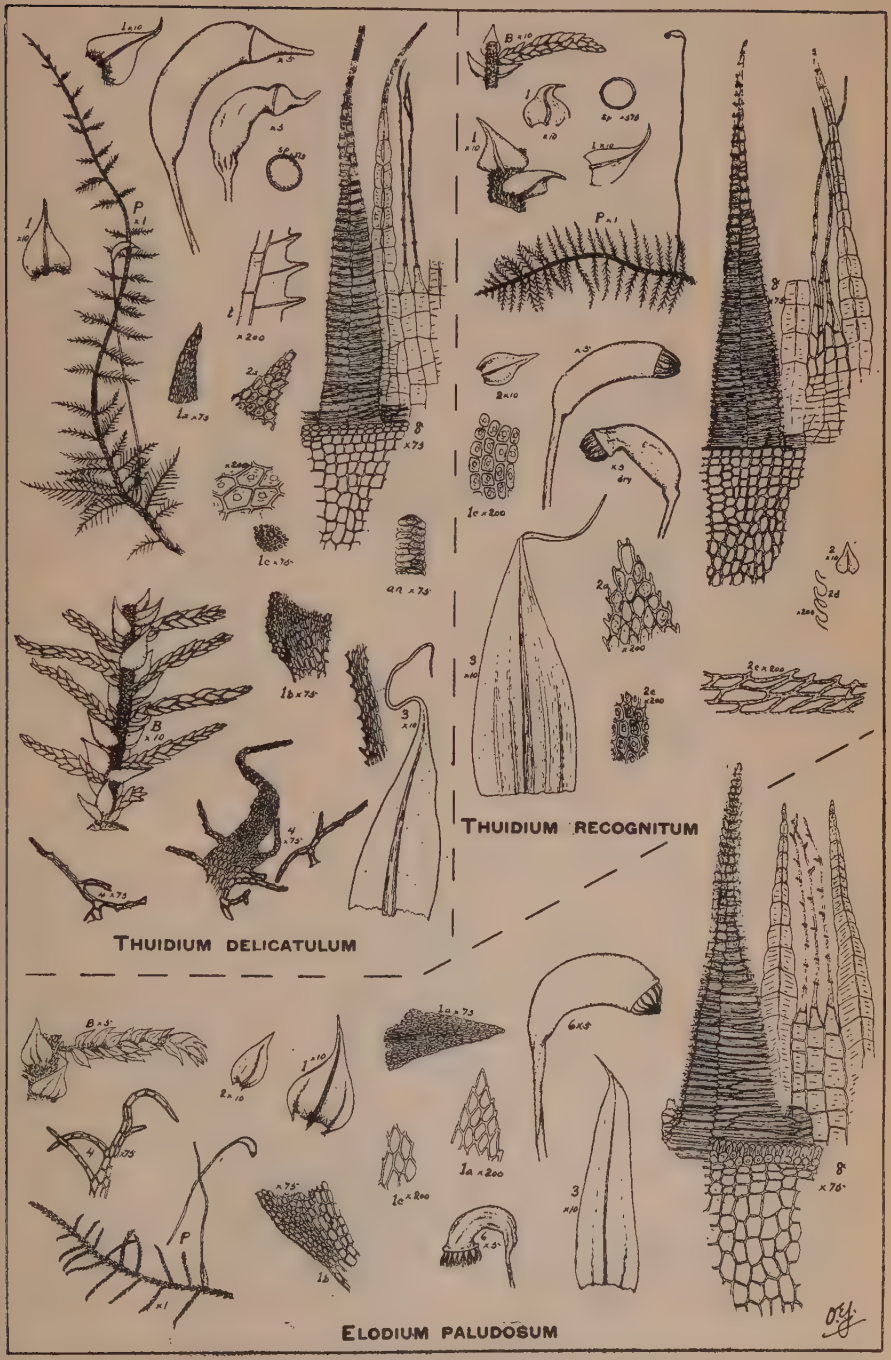

THUIDIUM DELICATULUM
THUIDIUM RECOGNITUM
ELODIUM PALUDOSUM

PLATE XXXVII

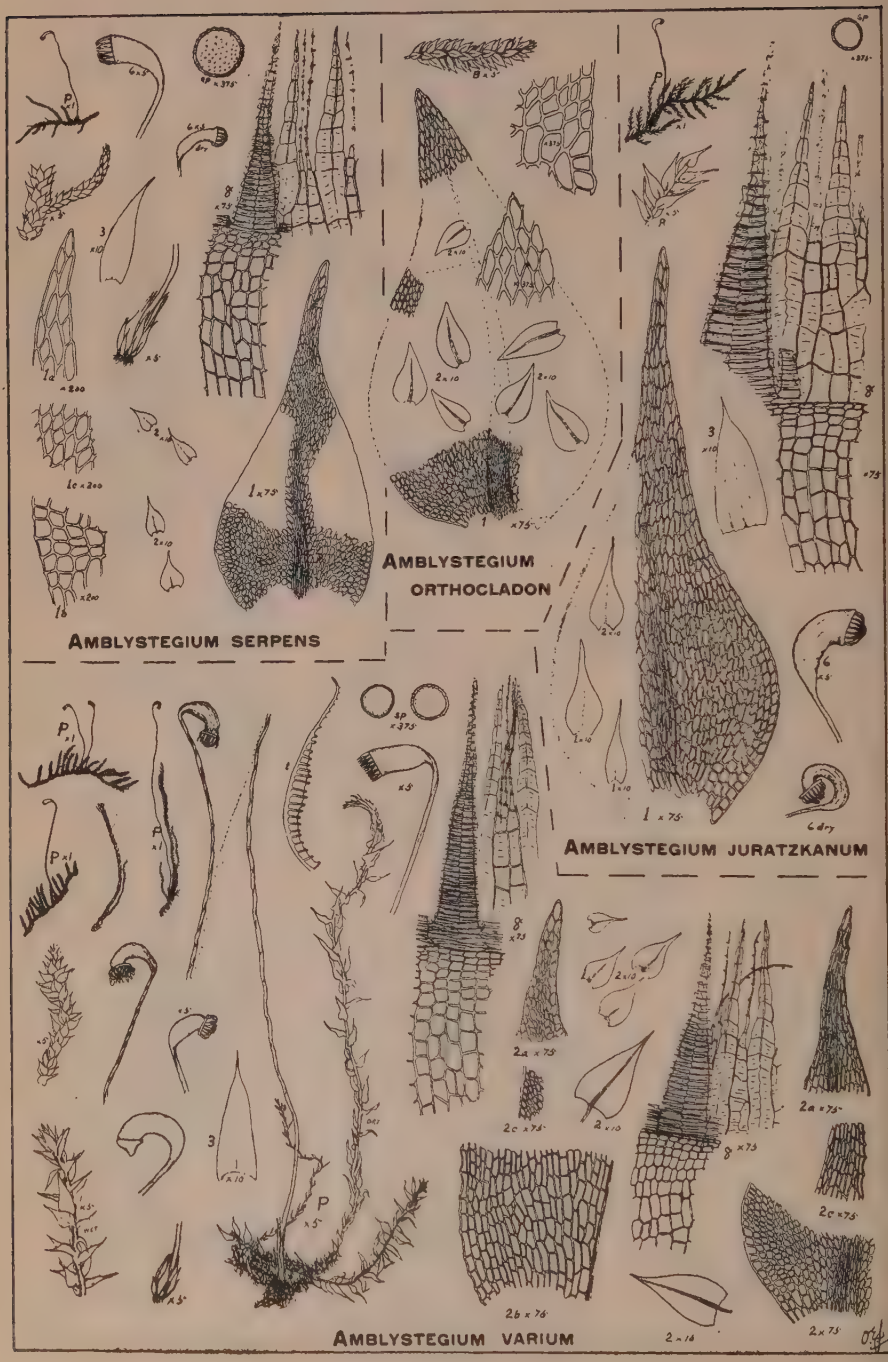


PLATE XXXVIII

PLATE XXXIX

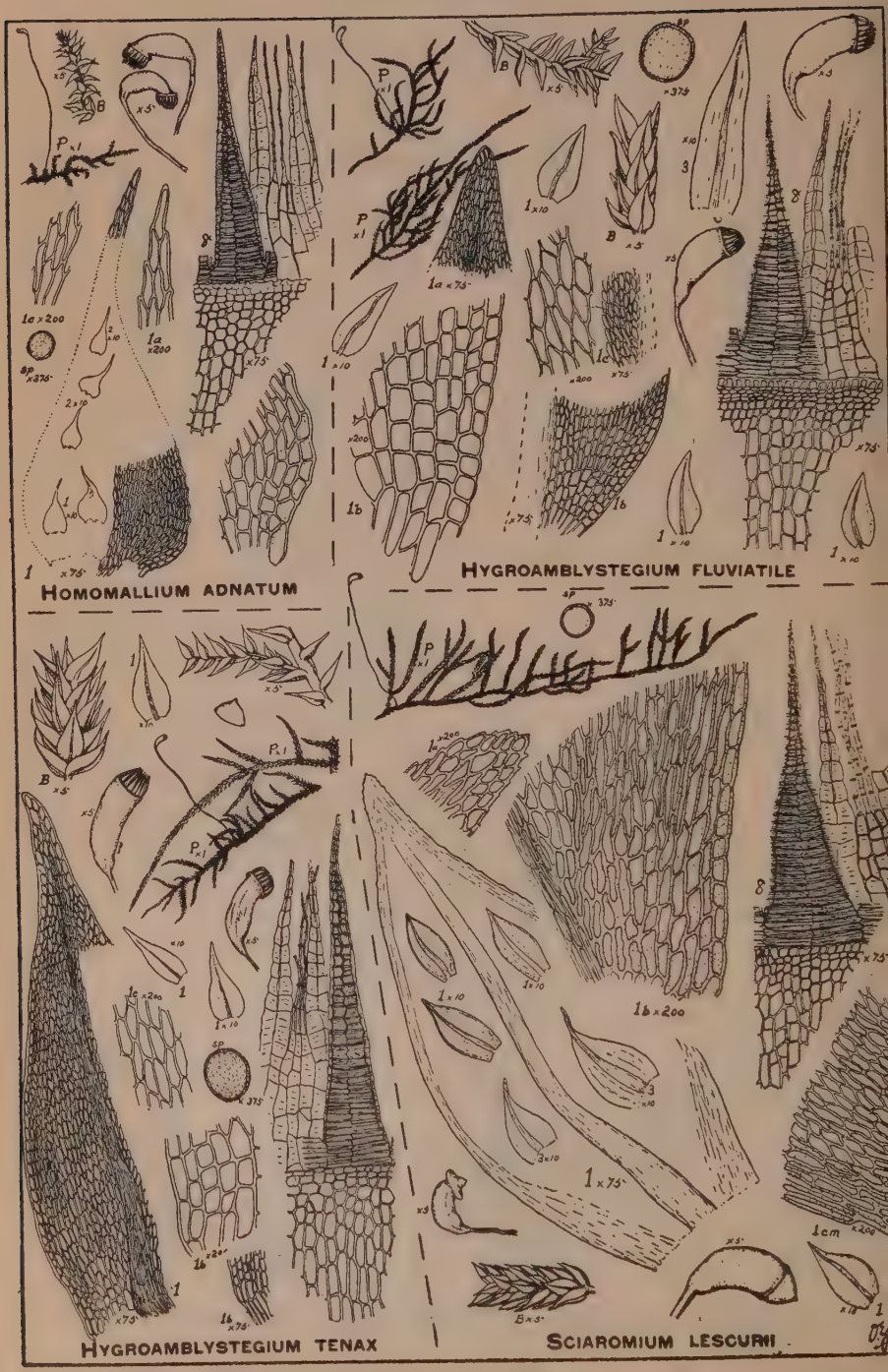

HOMOMALLIUM ADNATUM
HYGROAMBLYSTEGIUM FLUVIATILE
HYGROAMBLYSTEGIUM TENAX
SCIAROMIUM LESCURII

PLATE XL

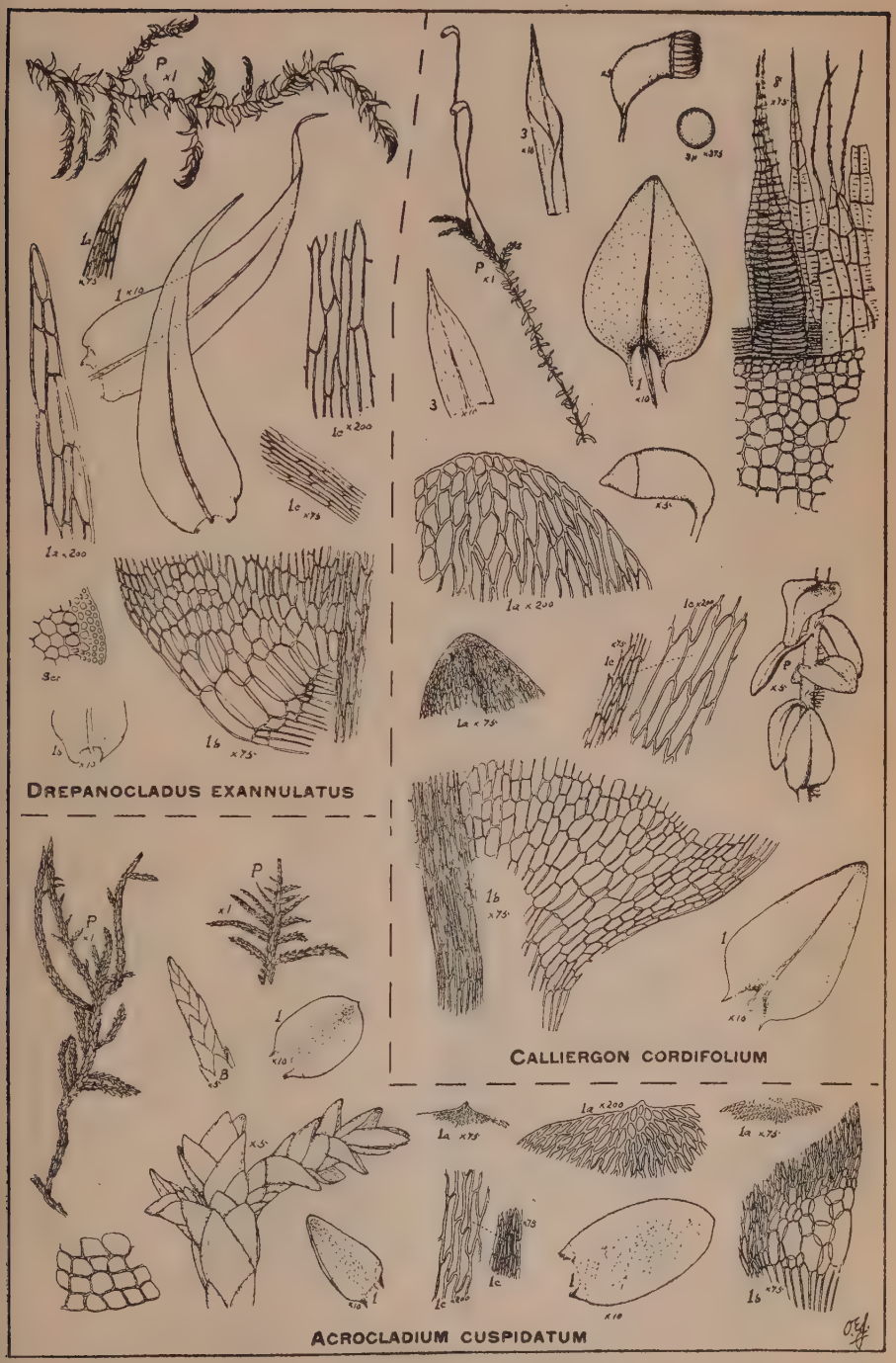

DREPANOCLADUS EXANNULATUS
CALLIERGON CORDIFOLIUM
ACROCLADIUM CUSPIDATUM

PLATE XLI

HYGROHYPNUM OCHRACEUM
HYGROHYPNUM EUGYRIUM VAR. MACKAYI
CAMPYLIUM HISPIDULUM
CAMPYLIUM CHRYSOPHYLLUM

PLATE XLII

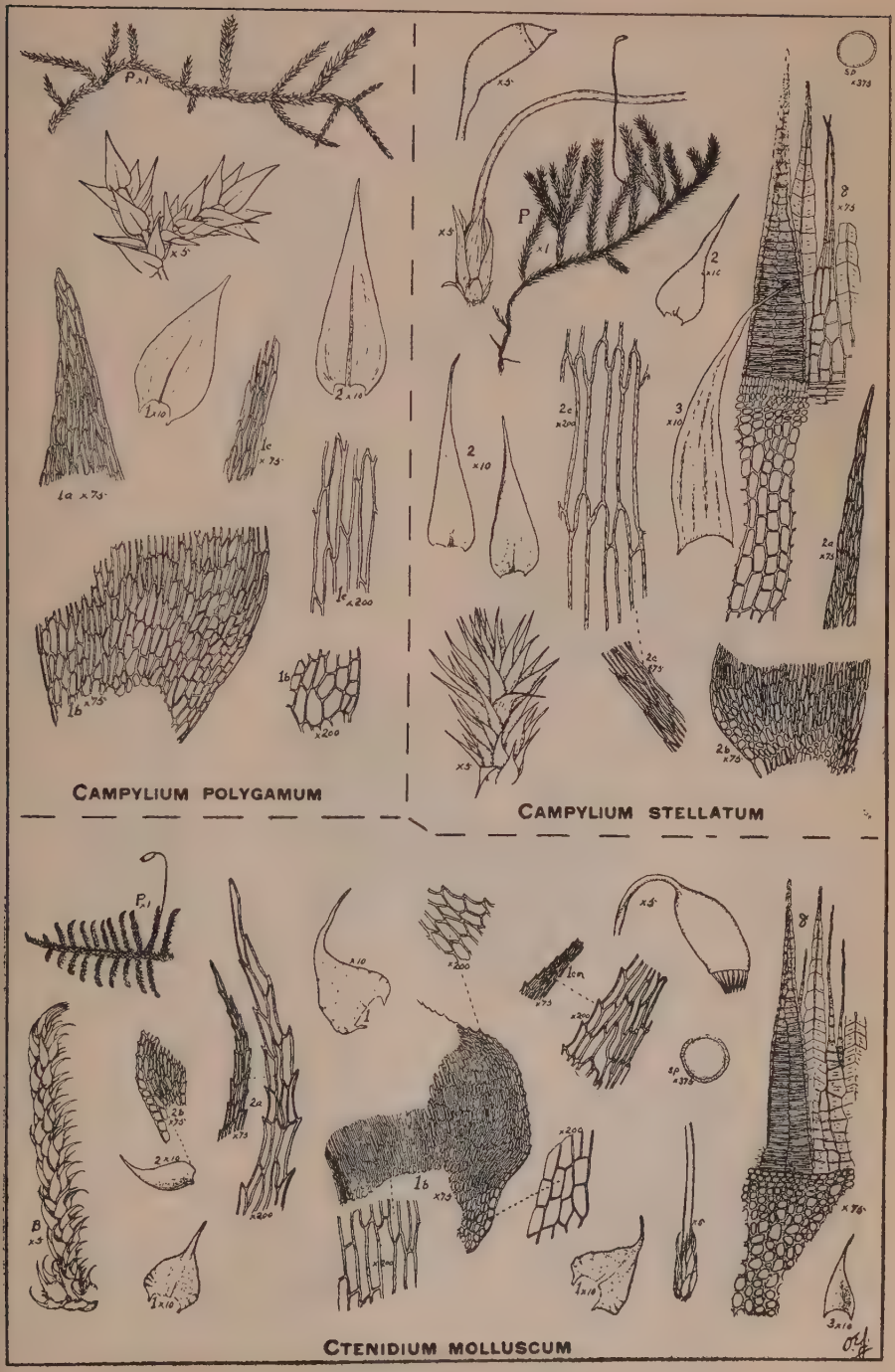

CAMPYLIUM POLYGAMUM
CAMPYLIUM STELLATUM
CTENIDIUM MOLLUSCUM

PLATE XLIII

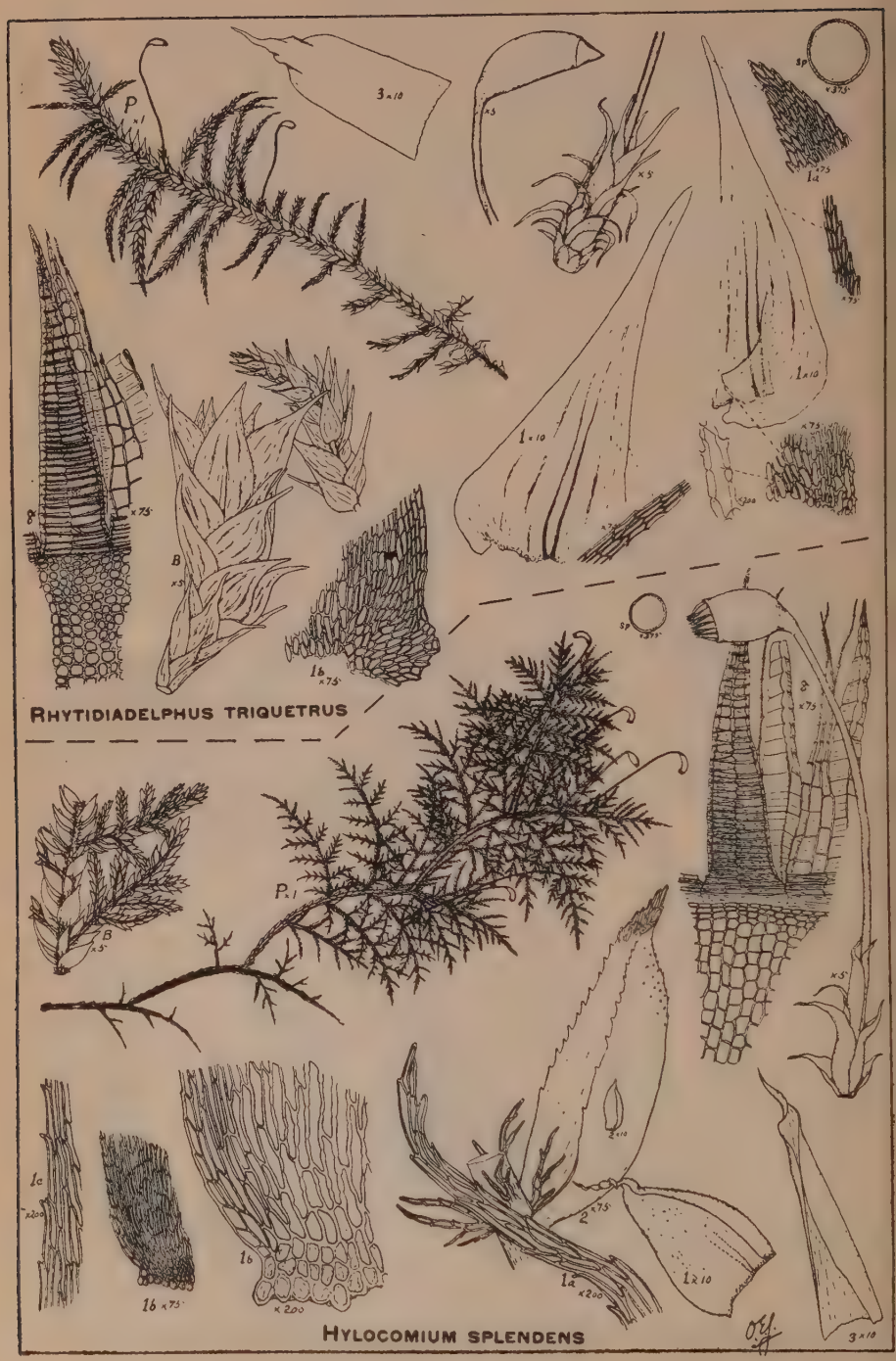


PLATE XLIV

HYLOCOMIUM UMBRATUM
HYLOCOMIUM BREVIROSTRE
HYPNUM SCHREBERI

PLATE XLV

STEREODON REPTILIS
PTILIUM CRISTA-CASTRENSIS
STEREODON FERTILIS
STEREODON IMPONENS

PLATE XLVI

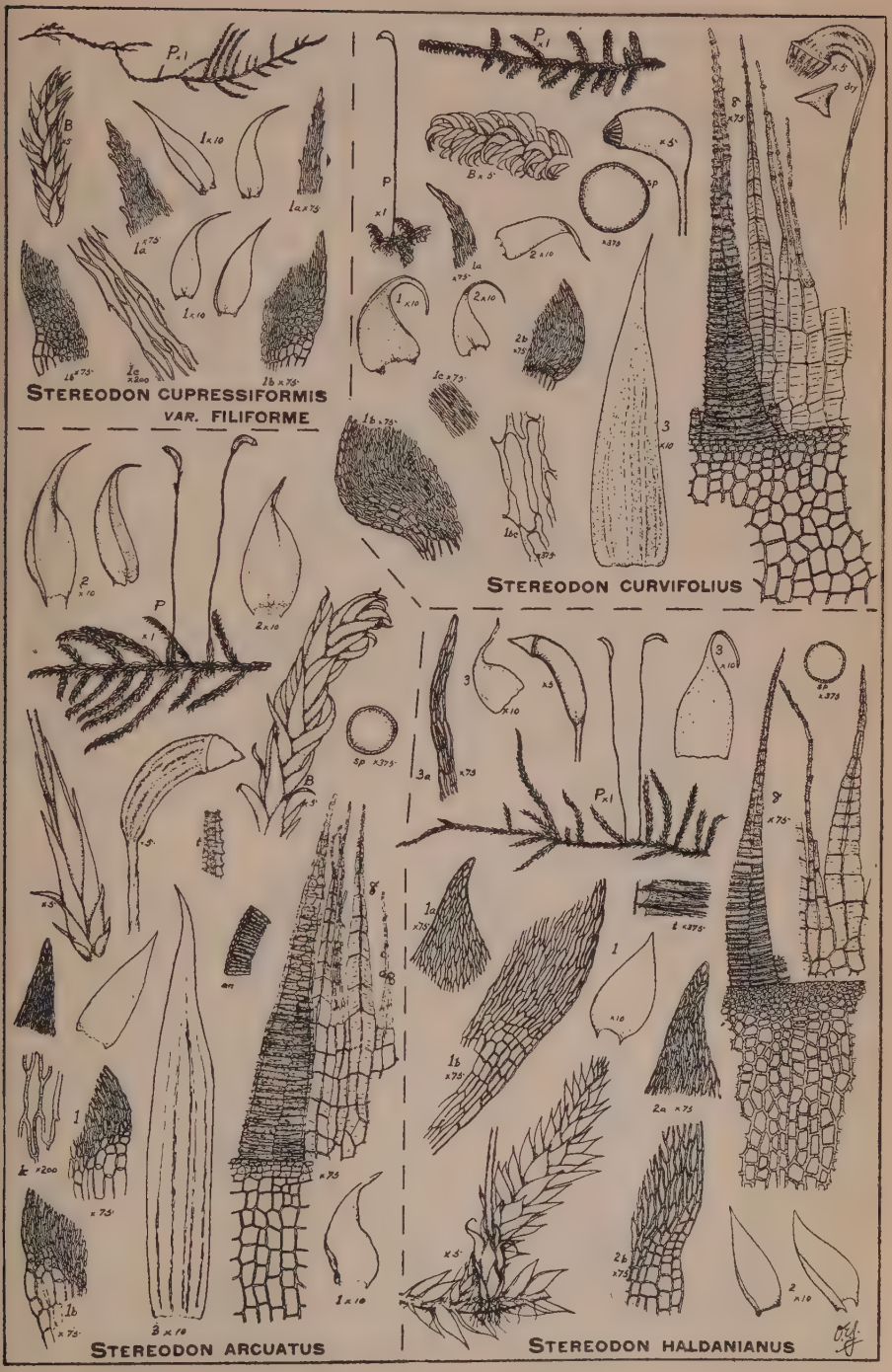

STEREODON CUPRESSIFORMIS
VAR. FILIFORME
STEREODON CURVIFOLIUS
STEREODON ARCUATUS
STEREODON HALDANIANUS

PLATE XLVII

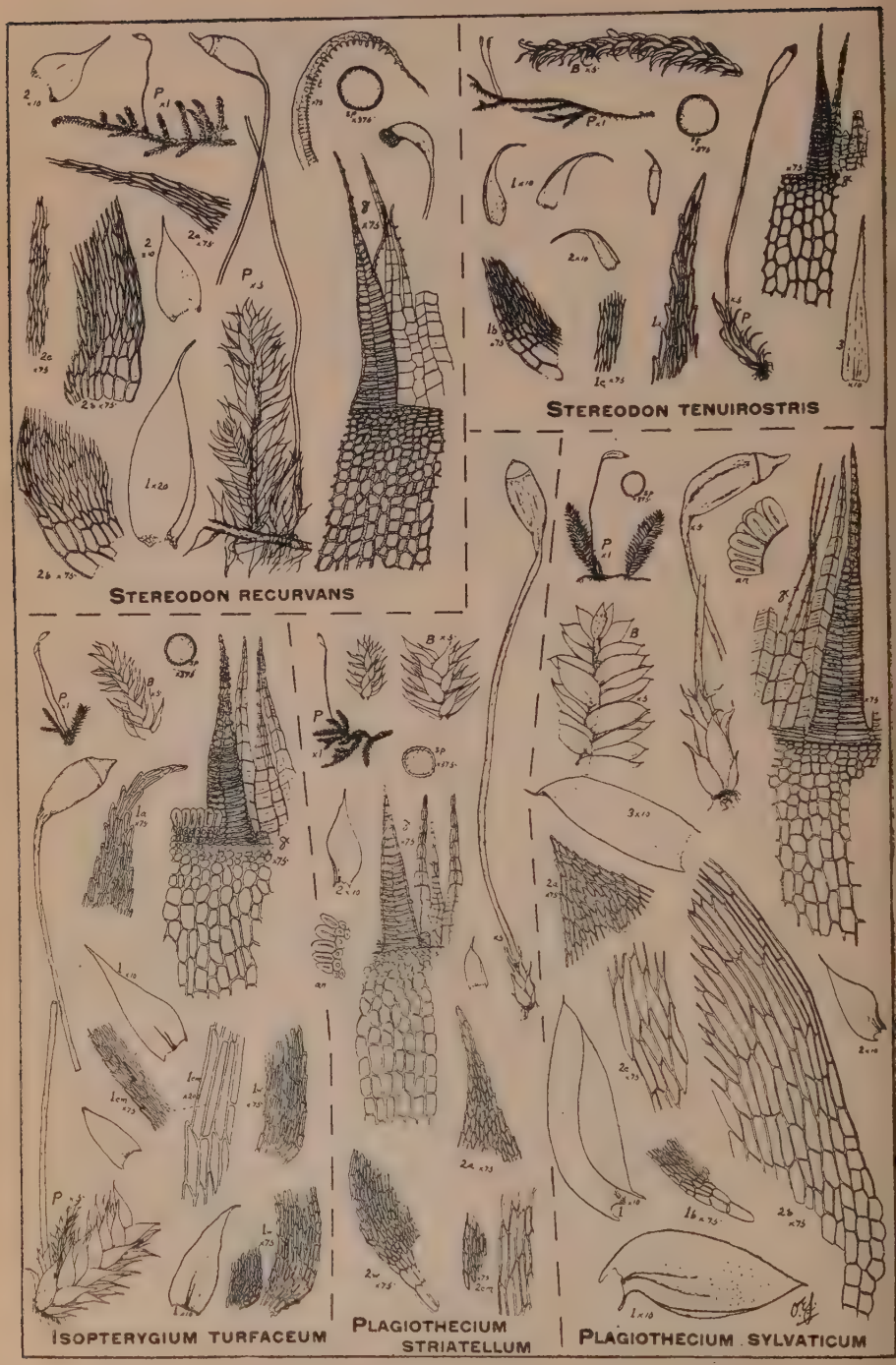

STEREODON RECURVANS
STEREODON TENUIROSTRIS
ISOPTERYGIUM TURFACEUM
PLAGIOTHECIUM STRIATELLUM
PLAGIOTHECIUM SYLVATICUM

PLATE XLVIII

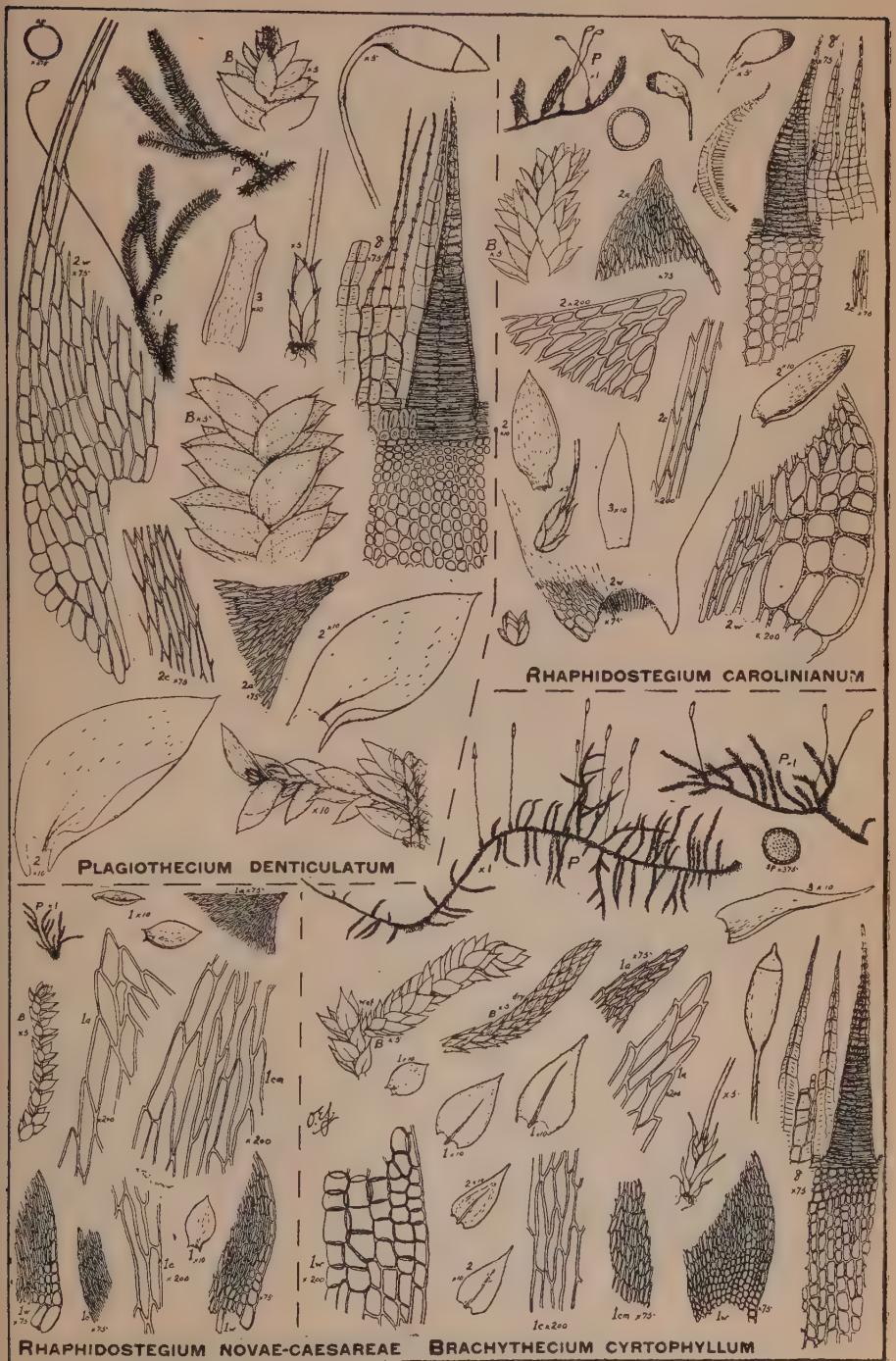


PLATE XLIX

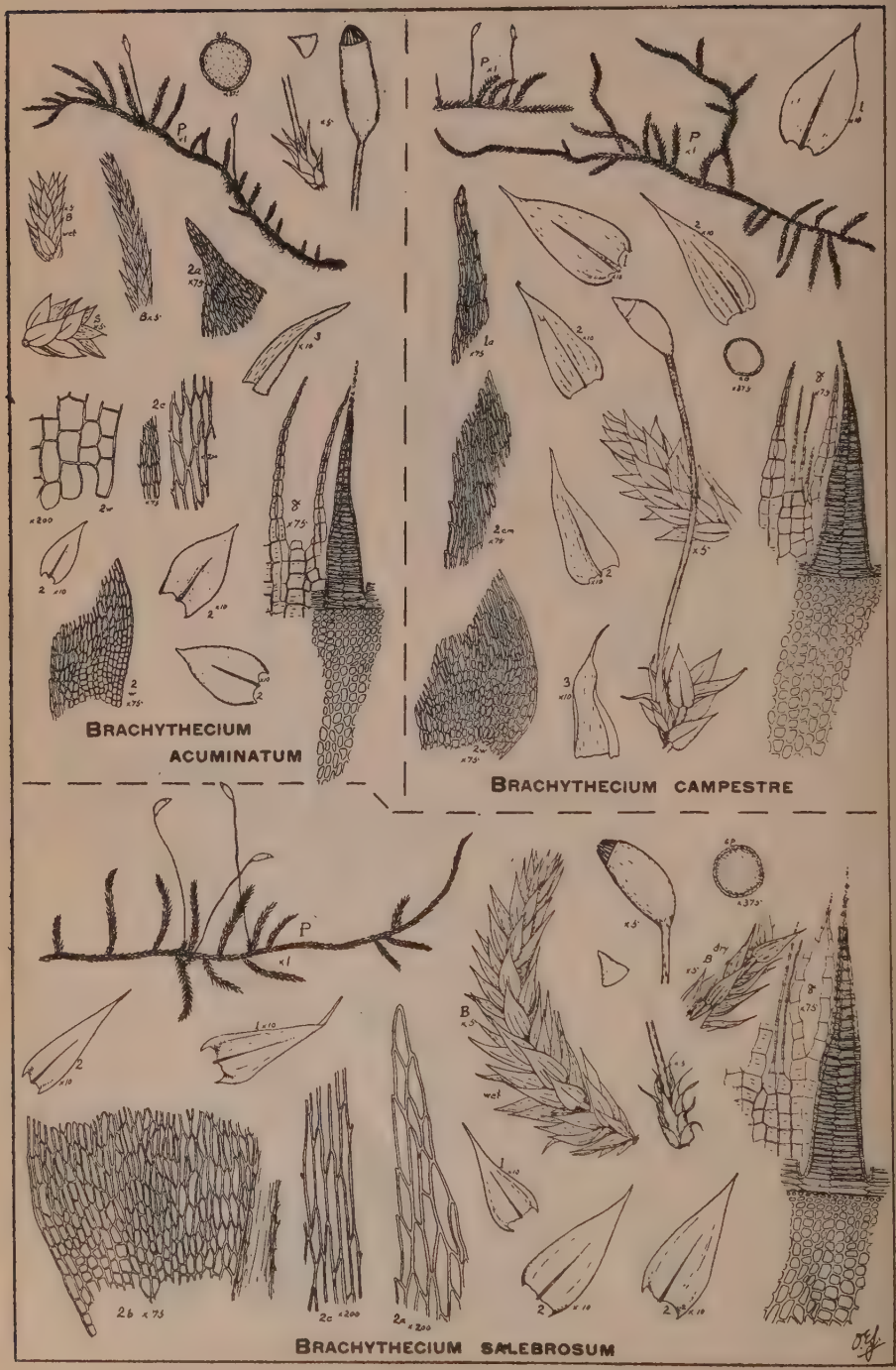

BRACHYTHECIUM ACUMINATUM
BRACHYTHECIUM CAMPESTRE
BRACHYTHECIUM SALEBROSUM

PLATE L

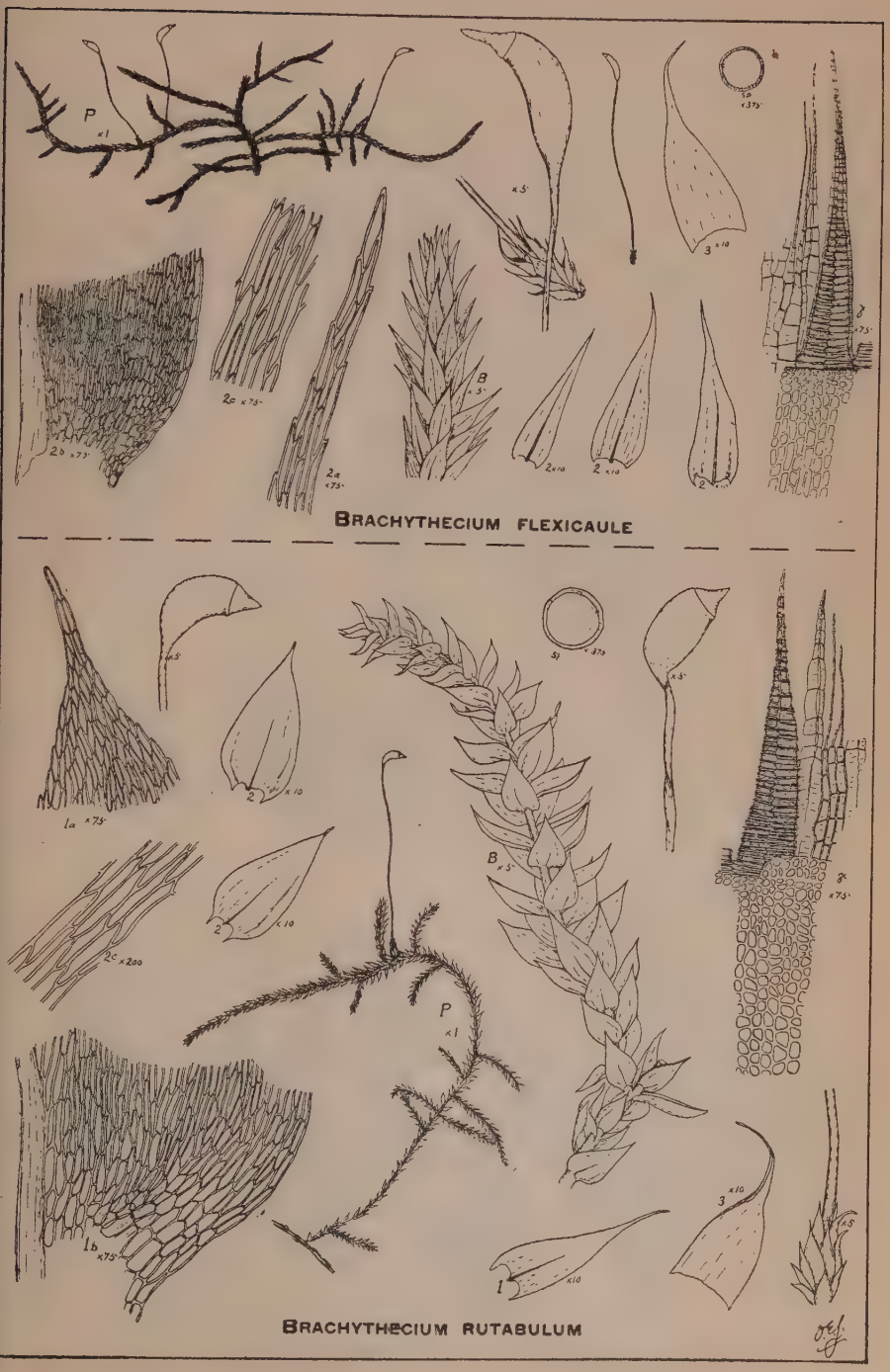

P ×1
×5
3 ×10
Sp ×375
2c ×75
2b ×75
2a ×75
B ×5
2 ×10
2
3
×75
BRACHYTHECIUM FLEXICAULE
1a ×75
×5
2 ×10
Sp ×375
B ×5
3
×75
2c ×200
P ×1
1b ×75
1 ×10
3 ×10
BRACHYTHECIUM RUTABULUM

PLATE LI.

BRACHYTHECIUM STARKEI
BRACHYTHECIUM RIVULARE
BRACHYTHECIUM VELUTINUM

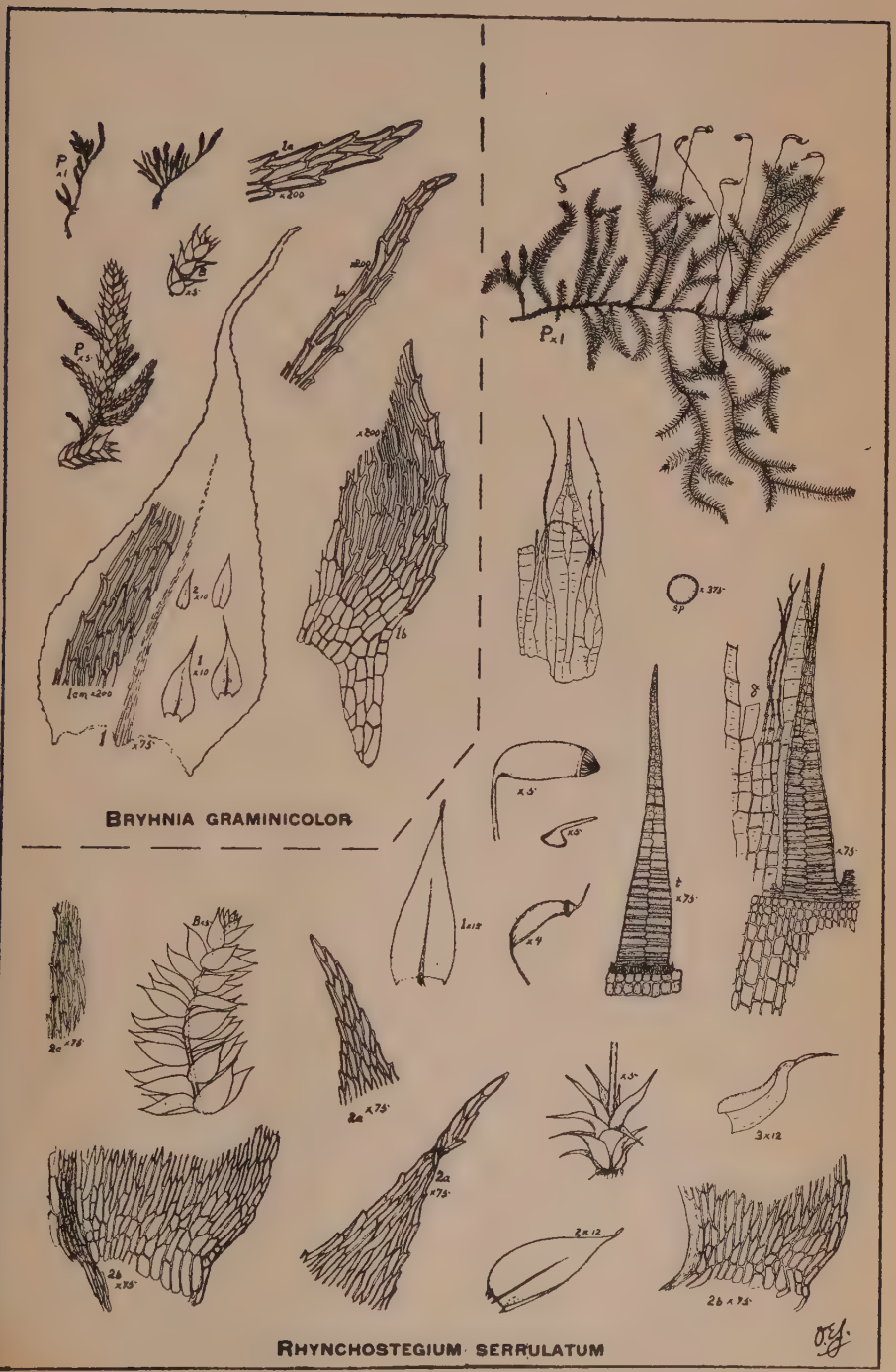
PLATE LII

VAR. HOMOMALLUM
BRACHYTHECIUM FLAGELLARE
BRACHYTHECIUM FLAGELLARE
CIRRIPHYLLUM BOSCII

PLATE LIII

OXYRRHYNCHIUM RIPARIOIDES
OXYRRHYNCHIUM HIANS
EURHYNCHIUM PULCHELLUM VAR ROBUSTUM

PLATE LIV



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of western Pennsylvania

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of western Pennsylvania